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DETROIT

Construction Methods

February
1933

Big steel penstock for San Francisquito power plant is electrically welded

This Month:

Slip forms speed continuous concreting of 120 circular bins for world's largest grain elevator at Port of Albany, N. Y.

Los Angeles installs first all-electric-arc-welded steel penstock at San Francisquito power plant.

"Selecting an Organization" is discussed in the fifth article of the series, "Helps to Successful Contracting," by Harry O. Locher.

Mile-long aerial tramway delivers gravel aggregate to screening plant at Madden dam in Canal Zone—by A. J. Ackerman.

Biggest building girder ever erected as unit is placed in New York Post Office addition.

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GASOLENE COSTS DROP 10 to 30%

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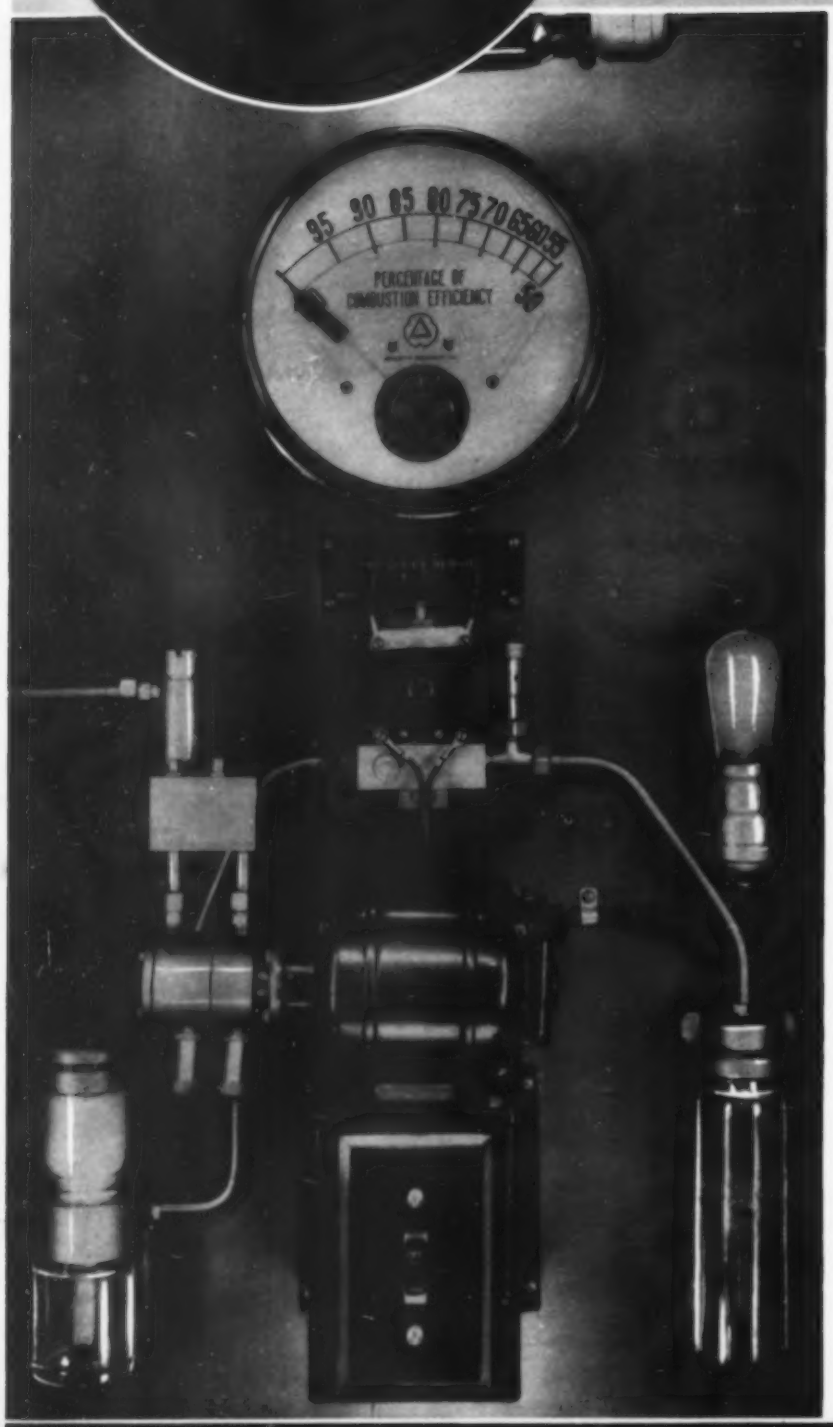

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TECHNOLOGY DEPT.

Construction Methods

McGraw-Hill Publishing Company, Inc., 330 West 42nd St., New York

Robert K. Tomlin, Editor

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Willard Chevalier, Publishing Director

For United Action

¶ For the first time in its history the construction industry, composed of scores of related but individually separate elements, consolidated its forces and spoke with a united voice last month. At the Highway and Building Congress, in Detroit, representatives of twenty-one national organizations of engineers, contractors, makers and distributors of equipment and producers of the materials of construction, met to devise and execute a plan for creating employment and stimulating business recovery generally by a revival of construction activity. The results of their deliberations are set forth in the accompanying platform of twenty-three planks, adopted by the Congress.

¶ Depending upon the ups and downs in the general curve of business, construction, to a greater degree than the consumer industries, alternates in the roles of prince and of pauper. Serving the needs of capital investment it has, of late, been a conspicuous target for attack in a nation-wide drive for economy, at any price. Time, however, is beginning to prove the fallacy of a general cessation of construction work, normally second only to agriculture in the volume of its operations and the opportunities it offers for employment directly on the job and indirectly in the mine, the mill and the manufacturing plant supplying the equipment and the materials for construction use. It is being realized that the dole is of doubtful value as a substitute for construction wages.

¶ The construction industry, rallying its scattered forces into a solid front at the Highway and Building Congress, has begun the fight to come back. Agreement has been reached on a plan of attack. That is only the preliminary step. The next move will demand aggressive leadership and a united following in putting that plan into action. The battle, long deferred, has been well begun.

A Platform for Construction

AS APPROVED by the Highway and Building Congress in Detroit, Jan. 19, the following resolutions constitute a platform of policies which the construction industry endorses as a means of restoring employment and aiding in the general recovery of business:

"Recognizing the gravity of the existing business emergency and desiring to assist in relieving it, we, the construction industry of the United States, as represented by twenty-one national organizations meeting in joint session in Detroit, Mich., Jan. 16 to 21, 1933, hereby adopt this platform of policies and measures for employment and business recovery. Construction is among the nation's largest industries and the revival of its activities will determine in large measure the recovery of prosperity. We confidently believe that general conditions are now favorable to resumption of business in its normal channels, if prompt and effective action is taken."

Against Dole

1. We are unalterably opposed to the dole system and strongly advocate in lieu thereof, first, an immediate constructive program of sound and needed public and semi-public improvements, and, second, the adoption of such measures as will hasten the resumption of private construction and industry. Among the public and semi-public projects are highways, waterways and other forms of transportation; flood control; housing; sanitation; waterworks; sewerage and refuse disposal; public buildings and other similar projects.

Capital Charges

2. We demand maximum economy in the current administrative and operating expenses of government, as well as an increased program of public works financed out of capital account. To further this end we urge that, wherever possible, the investment of the national government, states, cities and other governmental subdivisions in permanent improvements be charged into capital account, as is the practice of private industry, and that only the necessary carrying charges and amortization be included in current operating budgets.

Relief Act

3. In view of the ineffectiveness of the construction loan operations that have been carried on under the Emergency Relief and Construction Act, we advocate liberalization of self-liquidating requirements and reduction of interest rates by suitable amendments of that Act.

Service Charges

4. We appeal to states and municipalities to enact immediately legislation that will place upon a self-sustaining and self-liquidating basis through service charges such public services as sewerage and sewage disposal.

Work Relief

5. We urge that all public agencies engaged in distributing relief funds adopt the policy of applying these funds wherever possible through planned useful work instead of through welfare doles.

Federal Aid

6. We urge the extension of the date of completion of current emergency Federal Aid highway work from July 1 to Oct. 1, 1933.

7. We deplore the proposal that Federal aid to state highway improvement be curtailed or suspended at this time, and we urge Congress to continue the Federal aid policy by appropriating during the present emergency a sum equal to that appropriated last year, and in any event not less than the revenues from Federal taxes on gasoline and tires.

Motor Tax Diversion

8. We demand that the revenue raised from motor vehicle fuel taxes and license fees be used exclusively for highway construction and maintenance, and we oppose the diversion of these fees and taxes to other purposes.

City Streets

9. We advocate the extension of Federal aid to those portions of state and Federal aid highway systems within city limits, and we recommend such allocation as will give a fair proportion of the highway funds to municipalities for streets and roads within their corporate limits.

Highway Transportation

10. We endorse the proper and reasonable regulation of highway transportation, such regulation to be premised on sound economics and not on a desire to establish parity of cost with other forms of transportation.

Low-Rent Housing

11. We urge that all necessary measures be undertaken to promote the construction of adequate low-rental housing and that the various states enact legislation to grant the power of eminent domain for this purpose.

Interest Rates

12. Believing that the heavy interest charges of fixed obligations are a serious obstacle to early credit restoration, we urge, as an essential of economic recovery, that interest rates on such fixed obligations be reduced and adjusted by negotiation to conform to the general price level.

Bankruptcy Laws

13. We recommend that the Federal Government and the several states amend their bankruptcy and related statutes to simplify the process of reorganizing public and private financial structures by providing that approval of a substantial majority of bond or other certificate holders shall be sufficient to authorize such reorganization.

Deferred Payments

14. We urge that state laws and municipal charters, be amended to permit deferring payment for at least two years of the initial instalments of special assessments upon benefited property without penalty and at moderate interest.

Mechanics Lien Act

15. We endorse the Uniform Mechanics Lien Act prepared by the Standard State Mechanics Lien Act Committee of the United States Department of Commerce and the National Conference of Commissioners on Uniform State Laws, and urge the enactment of this legislation by state legislatures.

Government in Business

16. We urge that the Government cease engaging in any form of business and service not clearly necessary to the administration of governmental functions.

Public Works Dept.

17. We urge that the United States Congress establish a national department of public works.

Construction in Congress

18. In view of the vital relation of construction to public welfare, we urge that standing committees on construction be set up in both branches of the Congress of the United States, similar to those of agriculture, finance, etc.

Advance Planning

19. Believing that public and semi-public works can be carried out efficiently and economically only under a coordinated and balanced program of national, state and municipal works, we urge comprehensive advance planning of public improvements accompanied by long-term financial planning as the soundest policy of conducting public works; and we recommend that legislation to carry out such policy be enacted.

Sales Tax

20. We favor the enactment of an emergency general sales tax as a means of reducing other forms of taxation and furthering the program of public and semi-public improvements that we advocate.

Labor Currency

21. We recommend that if further financial measures are found necessary to restore employment and value, consideration be given by Congress to the establishment of a rigidly controlled increase of circulation by issue of currency based on labor and materials actually expended in useful construction, such currency to be issued only as compensation for work completed.

Rehabilitation

22. To give more immediate aid to the unemployed, we urge all communities to plan and put into effect an intensive campaign of rehabilitation and repair.

Machinery

23. While recognizing the urgency of reducing unemployment, we demand that public work be performed by the most modern and efficient methods, and we oppose the indiscriminate substitution of hand labor therefor.

A Time for Common Sense

LAST MONTH the construction industry assembled its many elements for the first time in a national Highway and Building Congress. At Detroit were gathered more than twenty national associations of architects, engineers, public officials, contractors, subcontractors, manufacturers of materials and equipment. The mere fact of their having thus come together is notable; it is an omen of hope and encouragement.

The representatives of these diverse groups are practical men. They faced the fact that the construction industry has been living through a difficult period because of the brakes that have been applied to investment by three years of declining business and earnings. They faced the fact that the indiscriminate demand of private business for lower costs of government has resulted too often in an unwise and destructive diversion of public funds from profitable investment and employment into wasteful and demoralizing doles. They faced the further fact that although each of the several groups may have its own peculiar problems, the vital problem of survival is common to them all.

And this attitude, first embodied in the 1933 Construction Congress, is a first step toward the integration of many diverse interests into a comprehensive and powerful industry, conscious of its importance, its strength, and its capacity to serve the community effectively in its present emergency.

There can be no question as to the essential place of construction in the scheme of American business. It provides all the fixed structures and works, both public and private, that make possible our modern life. Each year it converts nearly ten billions of our surplus earnings into current buying power for the goods and services produced by American industry. It employs millions of our people not alone in the field but also in the mines, the mills, and the shops that produce construction equipment and materials.

To contemplate seriously any stoppage or protracted suspension of this vital process is unthinkable. It is a time to use our cool common sense; not to abandon ourselves to senseless mistrust and misgiving. With increasing stability of general business, with restored earning power, and with rising confidence will return the insistent urge for investment and progress that has made America what it is today and that will continue to drive it forward for generations to come.

TO THIS END, **Construction Methods** seeks to contribute its share. At a time when low costs are needed to help restore earning power it brings to the industry the news of more efficient methods and equipment. During the period just ahead when investment resumes its normal volume it will continue to bring to the industry all the lessons that have been learned by engineers and constructors in the harsh but instructive school of adversity. And those lessons are the raw material out of which we shall build our next period of progress and prosperity.

Willard Chevalier

Publishing Director

In This Issue:

Largest Grain Elevator, for Port of Albany, N. Y. Capacity, 13,000,000 bu. Slip forms used for continuous concreting of 120 circular bins, 28 ft. in diameter and from 97 to 30 ft. high. Bulk cement handled by pumping and pipe line system.

Rivetless Steel Penstock. Pipe line 6 to 7 ft. in diameter, 1,400 ft. long, built to serve San Francisquito hydro-electric plant, California. Both shop and field joints made by electric-arc welding to resist static head of 530 ft.

Heaviest Steel Girder ever placed as unit in a building is erected in addition to New York Post Office. Weight, 133 tons; length, 155 ft. 10 in.; depth, 9 ft. 2 in. Delivery to job involved difficult trucking through city streets.

Mile-Long Aerial Tramway delivers concrete aggregates to screening plant for Madden dam, in Canal Zone. Traveling buckets carry material at rate of 225 tons per hour across tropical jungle.

Bridge Pier Caissons for Albany-Rensselaer bridge sunk to place from floating gantry trusses equipped with 4-in. diameter threaded rods.

Cast-Iron Roof of thin plates installed at New Jersey factory building.

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[Found on the Rex Moto-Mixer *Alone*]

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The Rex Jackass Hoist and One-Man Jiffy Spout will help you get jobs in these days of cut-throat competition.

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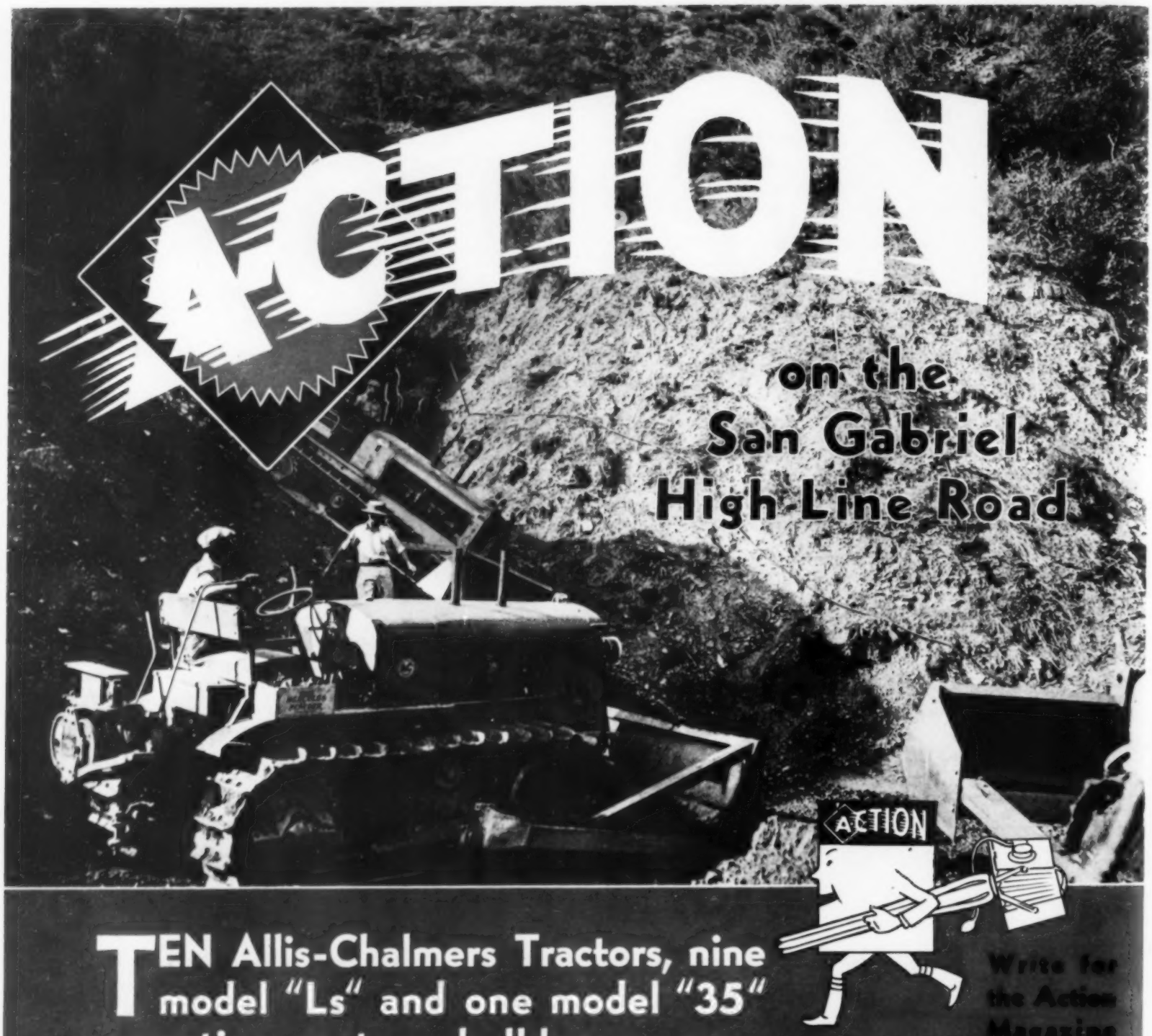

TEN Allis-Chalmers Tractors, nine model "Ls" and one model "35" operating rooters, bulldozers, cow-dozers, sheep foot rollers, and double drum winches in carving the High Line road out of the San Gabriel Mountains — are furnishing plenty of ACTION.

Write for the Action Magazine

A-C Tractors Continue to Move More Yardage at Lower Cost

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TRACTOR DIVISION—MILWAUKEE, U. S. A.

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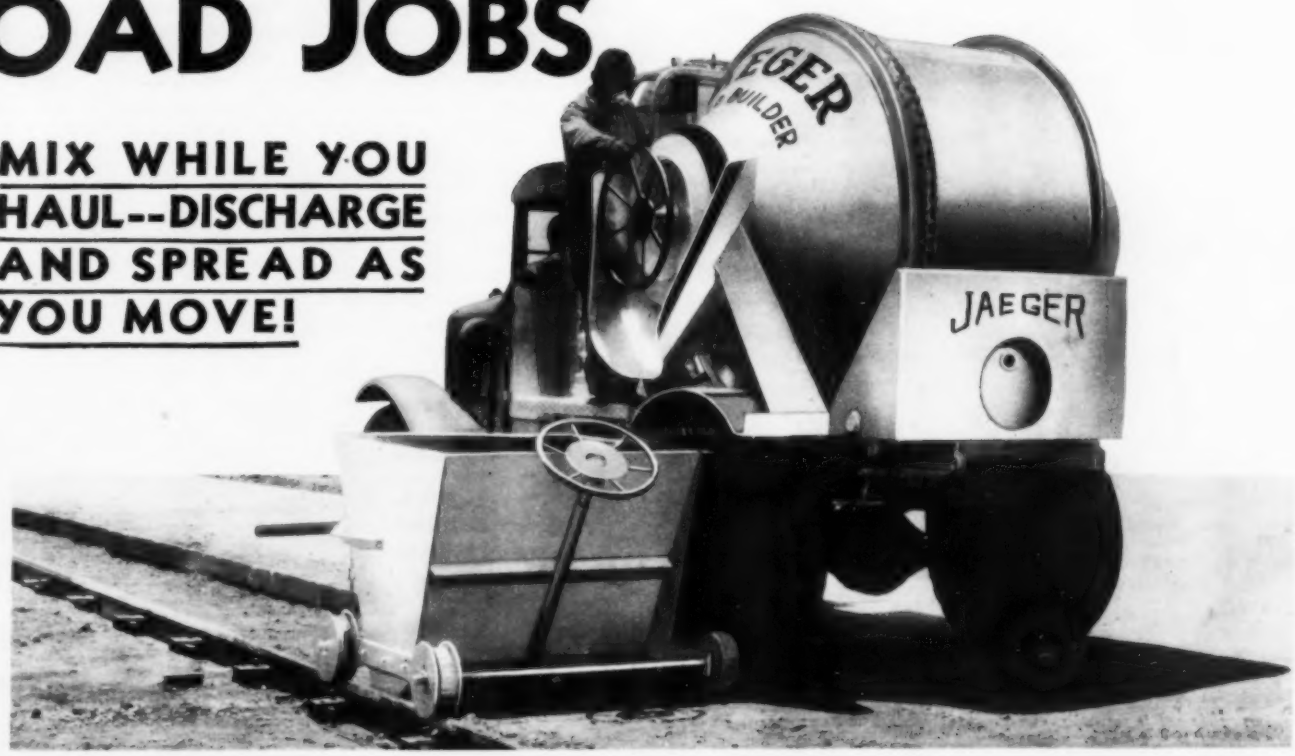
MIX WHILE YOU HAUL--DISCHARGE AND SPREAD AS YOU MOVE!



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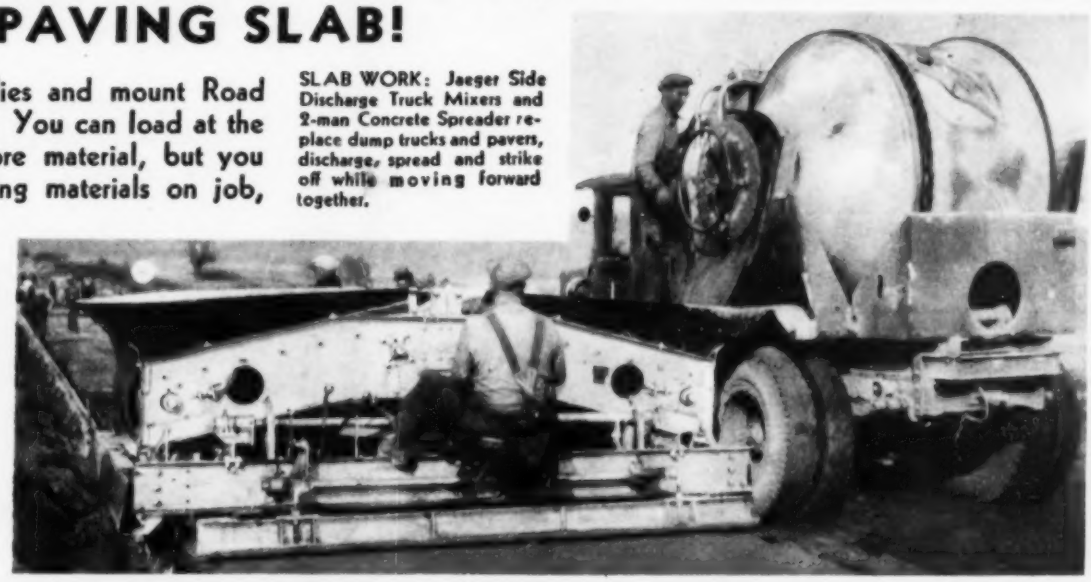
Throw off clumsy dump bodies and mount Road Builder Truck Mixers instead. You can load at the same plant, you haul no more material, but you eliminate dumping and mixing materials on job, you save real money on placing, you get a longer mixed, stronger and much more workable concrete. Popular priced plants for small work; big plants for big runs. Truck Mixers in 1 to 5 cu. yd. sizes. Write us. THE JAEGER MACHINE CO., 800 Dublin Ave., Columbus, Ohio.



SLAB WORK: Jaeger Side Discharge Truck Mixers and 2-man Concrete Spreader replace dump trucks and pavers, discharge, spread and strike off while moving forward together.

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MOST FOR YOUR MONEY

Construction Methods

ROBERT K. TOMLIN, Editor

Established 1919—McGraw-Hill Publishing Company, Inc. Volume 15—Number 2—New York, February, 1933

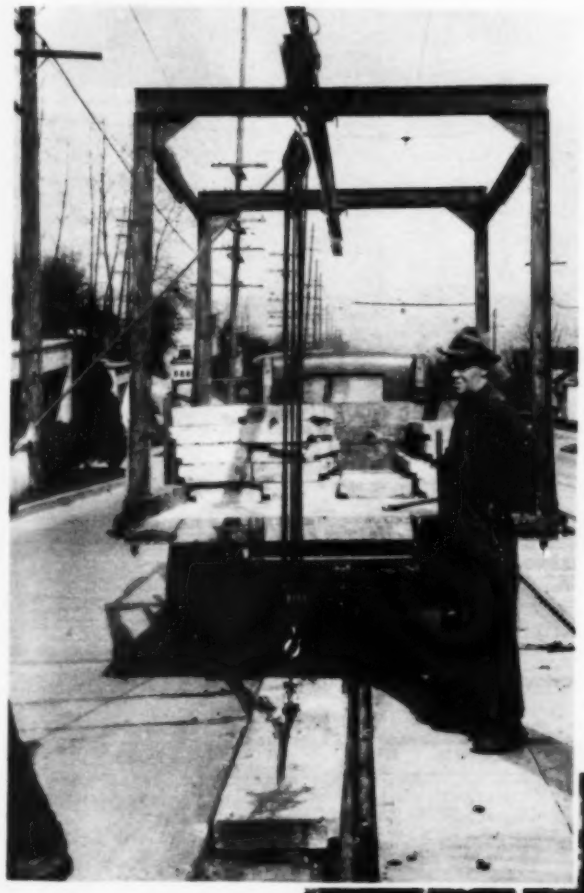
Street Railway Track Area Paved With

PRECAST SLAB UNITS

PRECAST concrete slabs are used by the Seattle Municipal Street Railway for paving between street-car tracks. These slabs were first designed and used under the direction of A. E. Pierce, assistant superintendent, and have proved both structurally successful and economical. The installation is considered a temporary expedient pending the availability of funds for permanent paving on track sections.

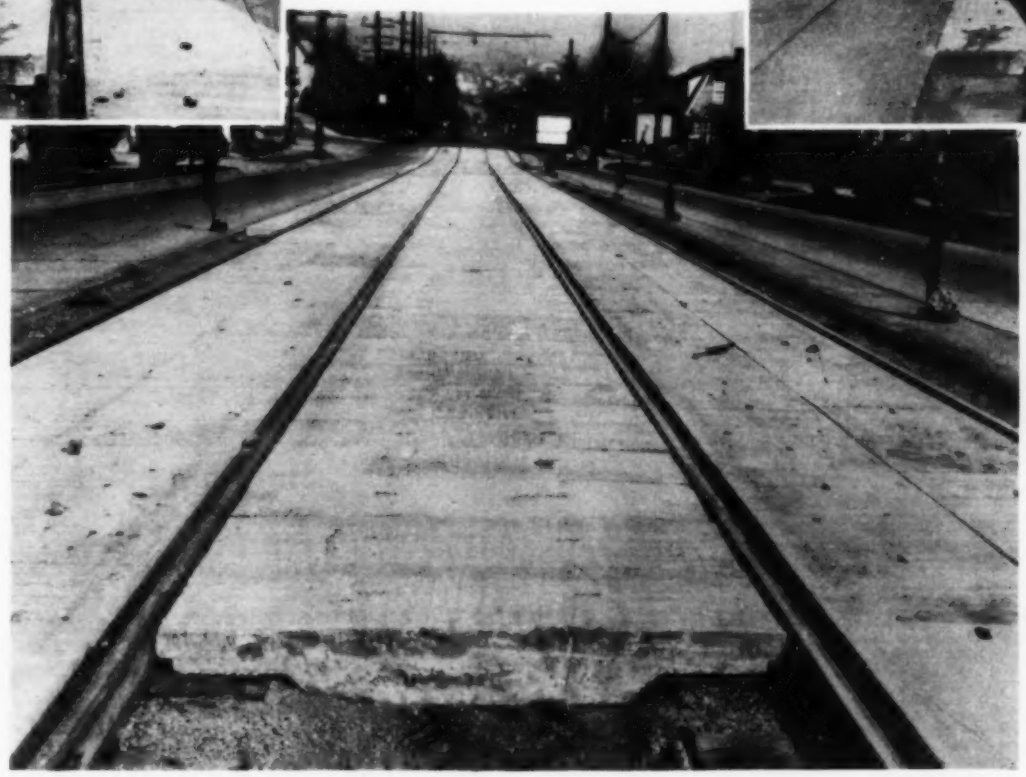
The slabs are of reinforced concrete 4½ in. thick and of varying lengths and widths. Cost is about $6 per linear foot in the 18-ft. width occupied by a double-track car line. Slabs between the rails and on the outside of the two tracks are placed parallel to the rails and those for the "dummy," in and between the tracks, are placed in the other direction.

Any rocking movement of the slabs is corrected by sweeping fine sand into the joints.



STEEL FRAME on truck, equipped with cantilevered I-beam track for hand-hoist, facilitates handling of precast paving slabs.

PRECAST SLABS are of reinforced concrete 4½ in. thick and of varying lengths and widths. Sand swept into joints corrects rocking movement.



BETWEEN TRACKS *(left)* precast slabs are laid transversely. Elsewhere units are placed longitudinally.

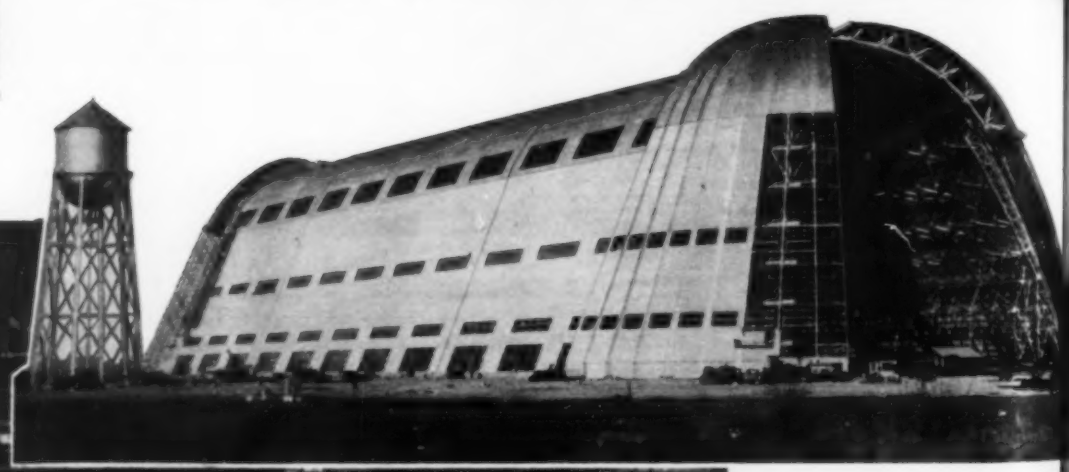
This Month's

NEWS REEL

TO FEED PANAMA CANAL *(right).* **Madden dam is being built across Chagres River in Canal Zone to form reservoir for augmenting water supply for canal lockages. Structure costing $4,000,000, designed by U. S. Bureau of Reclamation, has main concrete section 900 ft. long and 220 ft. in maximum height, flanked by paved earth and rock embankment extension. Excavation and concrete are handled by 25-ton capacity cableway having span of 1,325 ft. Diversion channel (through center of picture) is almost ready to receive flow of river. Contractors are W. E. Callahan Construction Co. and Peterson, Shirley & Gunther.**

Keystone-Underwood

HALL OF SCIENCE, one of the modernistic structures for Chicago's Century of Progress Exposition, to open this summer, is illuminated by concealed neon lights.



Wide World

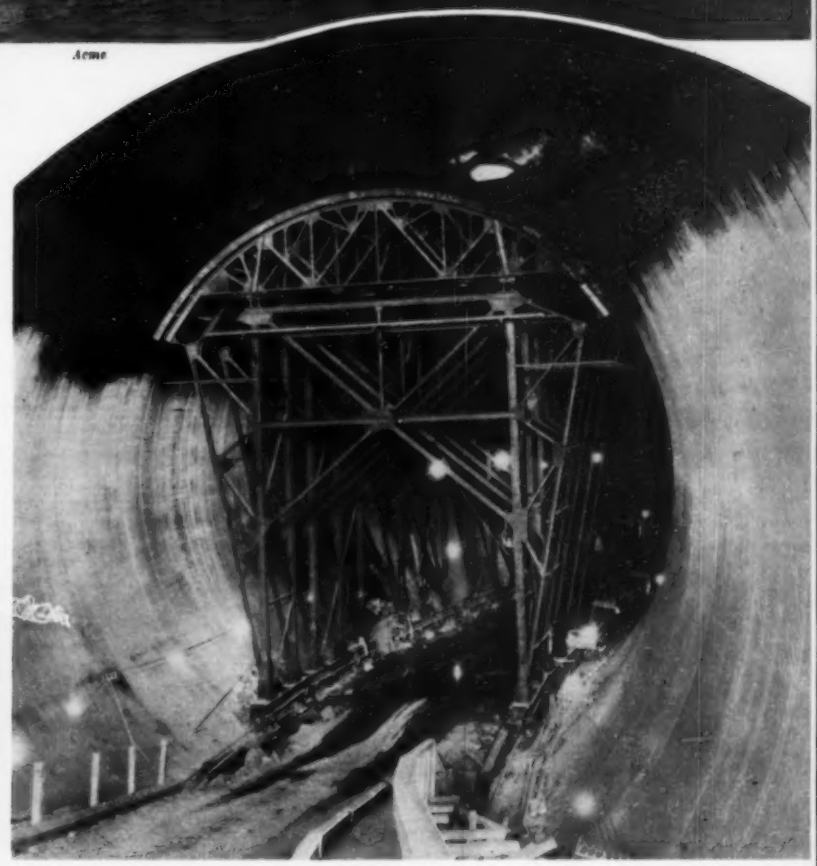
AIRSHIP DOCK has been completed for U. S. Navy at Sunnyvale, Calif., to house the giant dirigible, "Akron," soon to be put in commission. Unusual steel-frame structure of arch trusses, erected by J. H. Pomeroy & Co., for the Wallace Bridge & Structural Steel Co., of Seattle, is 194 ft. high and 1,117x308 ft. in plan. For the Navy construction was in charge of Lieut.-Commander E. L. Marshall.

NEW STATE CAPITOL has been completed at Charleston, W. Va. Structure, designed by Cass Gilbert and built by George A. Fuller Co., consists of 520x120-ft. main unit and two wings, topped by illuminated copper dome 260 ft. high. Exterior is faced with Indiana limestone and interior with Vermont marble. Main unit cost $4,600,000 and wings, $1,400,000 each.

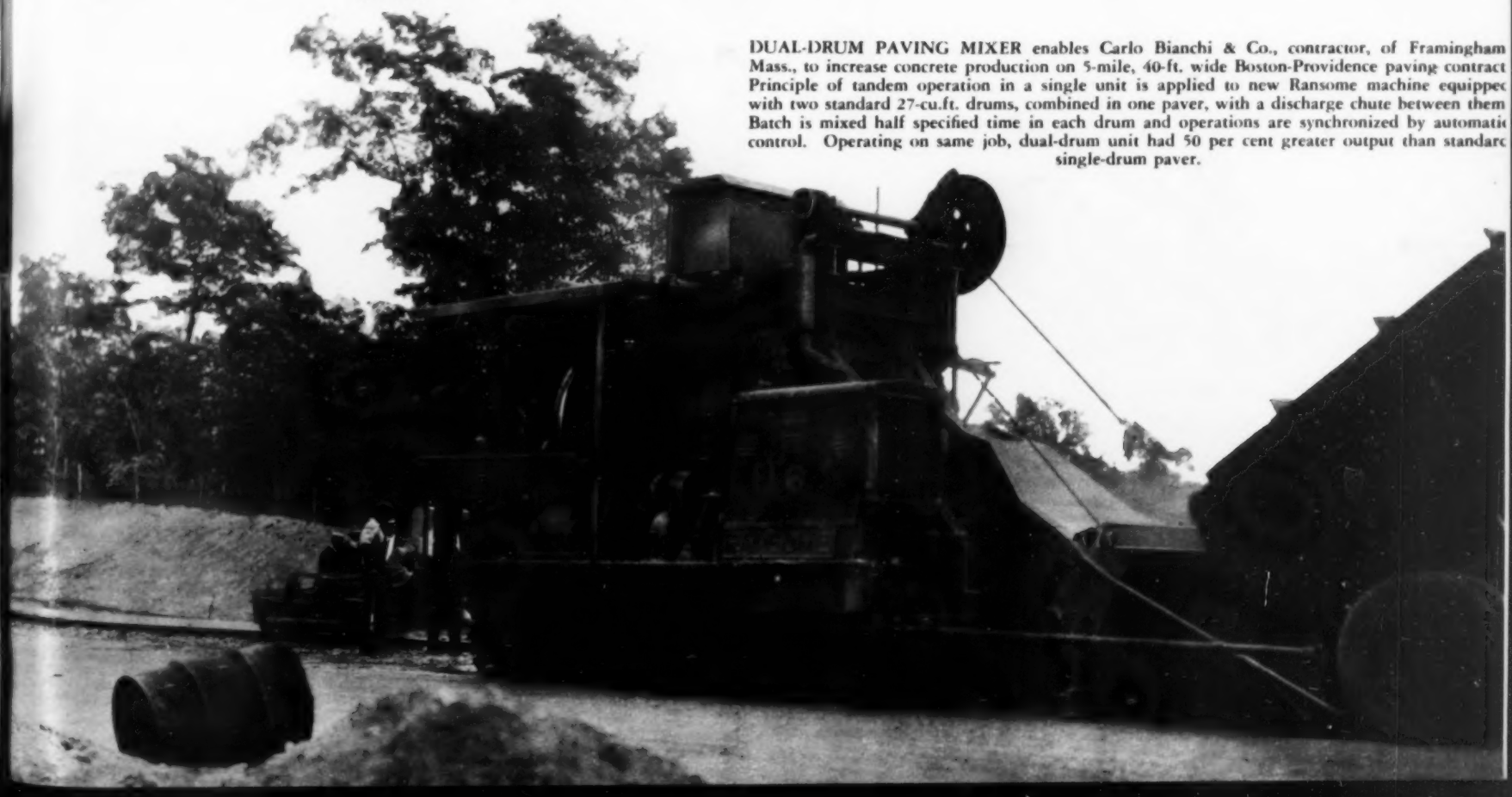
MUSCLE SHOALS on Tennessee River, Alabama, quiescent since Wilson dam and power plant for nitrate manufacture was undertaken in days of World War, assumes news interest as result of recent visit of inspection by President-elect Franklin D. Roosevelt, who may announce new plans for utilizing government-built project after he takes office in March.

Acme

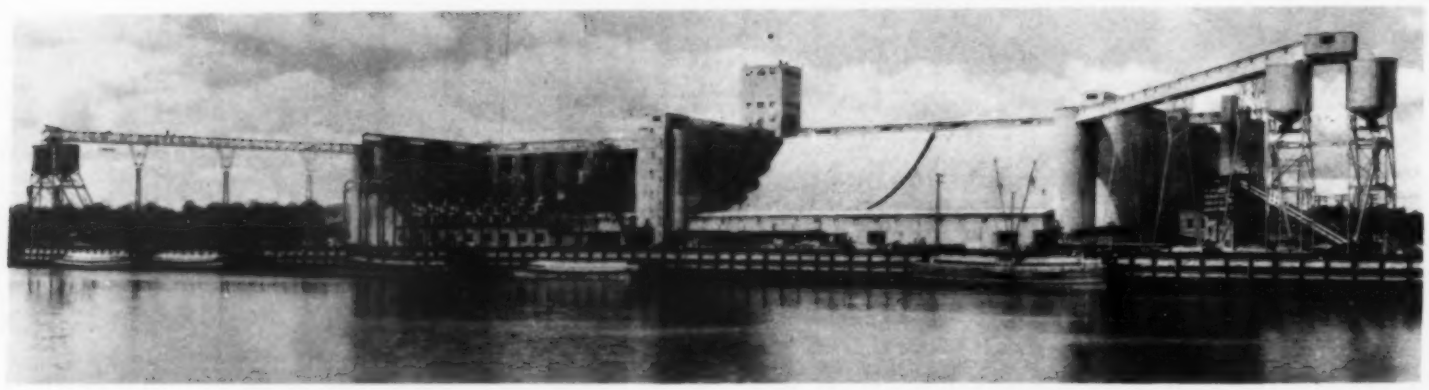
UNION INLAND FREIGHT STATION, occupying entire city block, has been built for Port of New York Authority by Turner Construction Co., at cost of $8,750,000. Huge structure with volume of 38,000,000 cu.ft. and floor area of 2,500,000 sq.ft. required 24,000 tons of structural steel and 113,000 cu.yd. of concrete. The building, 200x800 ft. in plan and 16 stories high, handles less-than-carload freight for eight railroads.



LINING DIVERSION TUNNELS at Hoover dam. Six Companies, Inc., contractor place 300,000 cu.yd. of concrete to form 3-ft. thick shells, 50 ft. in inside diameter, four 4,000-ft. long rock bores in sides of Colorado River Canyon. Arch forms a supported by tall structural steel framework moving on rails.



DUAL-DRUM PAVING MIXER enables Carlo Bianchi & Co., contractor, of Framingham Mass., to increase concrete production on 5-mile, 40-ft. wide Boston-Providence paving contract Principle of tandem operation in a single unit is applied to new Ransome machine equippe with two standard 27-cu.ft. drums, combined in one paver, with a discharge chute between them Batch is mixed half specified time in each drum and operations are synchronized by automati control. Operating on same job, dual-drum unit had 50 per cent greater output than standar single-drum paver.



GRAIN ELEVATOR at Port of Albany on Hudson River has storage capacity for 5,000,000 bu. in 120 circular concrete bins and for 8,000,000 bu. in open spaces under four suspended steel-plate roofs. One of suspended roofs can be seen almost completed.

Slip Forms Speed Circular Grain Bin Construction by CONTINUOUS CONCRETING

SKILL born of long experience in the construction of grain elevators enabled the James Stewart Corp., of Chicago, general contractor, to attain remarkable speed in building circular reinforced-concrete bins of 5,000,000-bu. capacity at the 13,000,000-bu. grain elevator of the Port of Albany, N. Y. Capable design and utilization of construction plant which was adequate for the speed desired, coupled with expert supervision and coordination of operations, resulted in the completion of 120 circular concrete bins in a brief period. Continuously rising slip forms and a central concrete plant of large capacity were the chief mechanical aids to the rapid rate of construction.

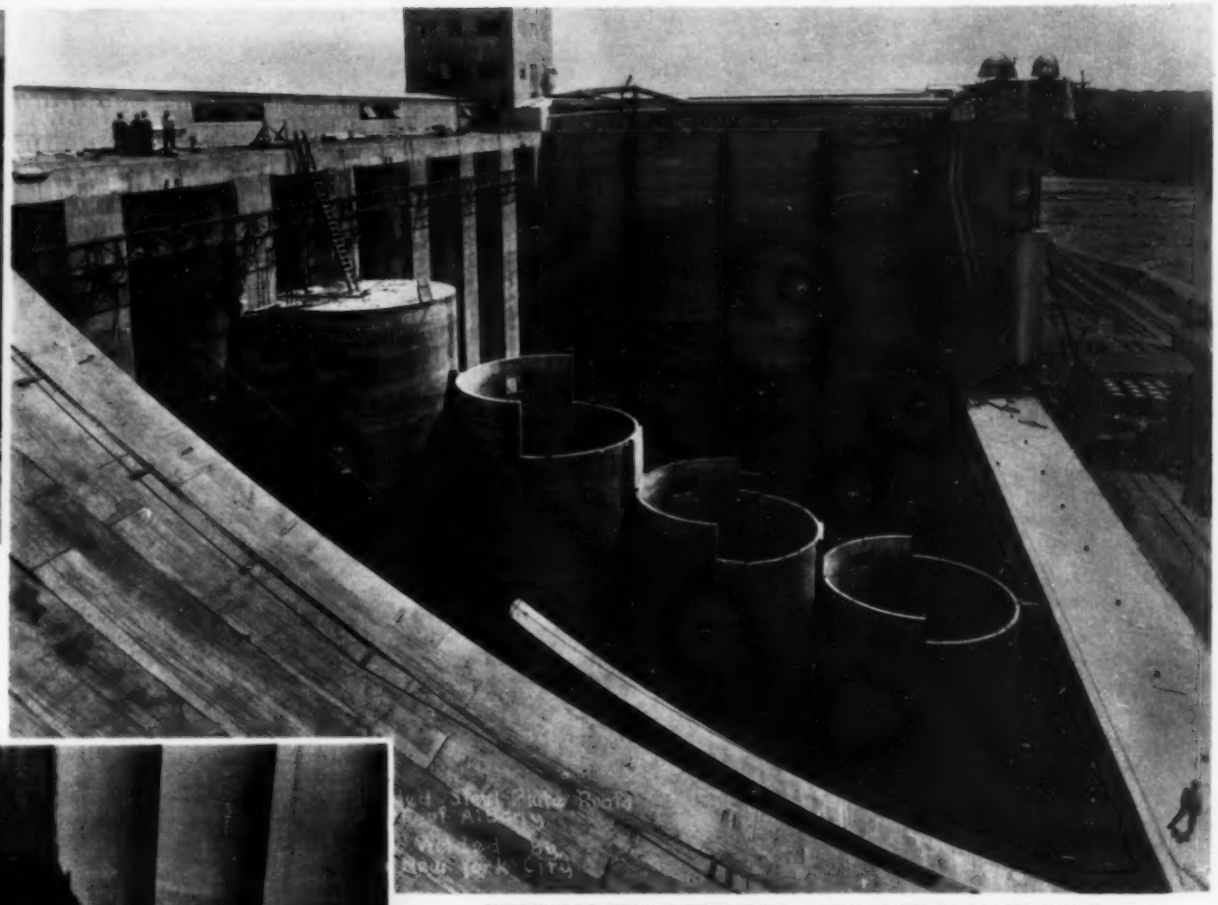
Its total capacity of 13,000,000 bu. earns for the grain elevator at Albany the distinction of being the largest single unit of its kind in the world. In addition to the 5,000,000-bu. capacity of the circular concrete bins, 8,000,000-bu. storage is provided in bins covered by suspended, welded steel roofs, construction of which will be described in next month's issue of CONSTRUCTION METHODS. The elevator is intended principally for transshipment to ocean-going ships and to rail and motor truck of grain coming by rail or barge from the Great Lakes region. It is only one part of a general port development.

Port of Albany. Development of the port is being carried out by the Albany Port District Commission. A special act of the state legislature created the port district, which includes the city of Albany on the west side of the Hudson and that of Rensselaer on the east bank. The commission has provided a turning basin, wharves, transit sheds, warehouses, lumber storage, and other port facilities in addition to the grain elevator. A channel recently completed by the federal government has opened the

FOUNDATIONS for circular bins are concreted by hopper-body trucks which discharge from ramps into chutes covering wide area. Gates in bin floors open into tunnel.

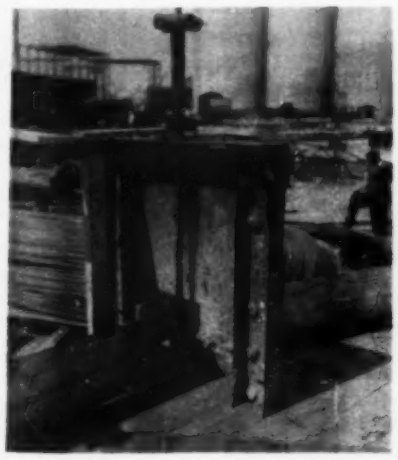
SLIP FORMS (*below*) for 7-in. walls of reinforced-concrete cylindrical bins are erected on foundations. Steel jack blocks carry inside and outside circular forms.

ERECTING steel grain tanks from which spouts will deliver cargo to ships. Belt conveyor on bridge will transport grain from elevator to tanks.



SUSPENDED SELF-SUPPORTING, WELDED STEEL-PLATE ROOF covering area about 280x120 ft. is erected in strips 50 in. wide which later are welded to one another to form solid steel sheet.

TWO STEEL TRUSSES (in shortest bin) spanning between studding trusses of inside circular form, support working platform during construction.



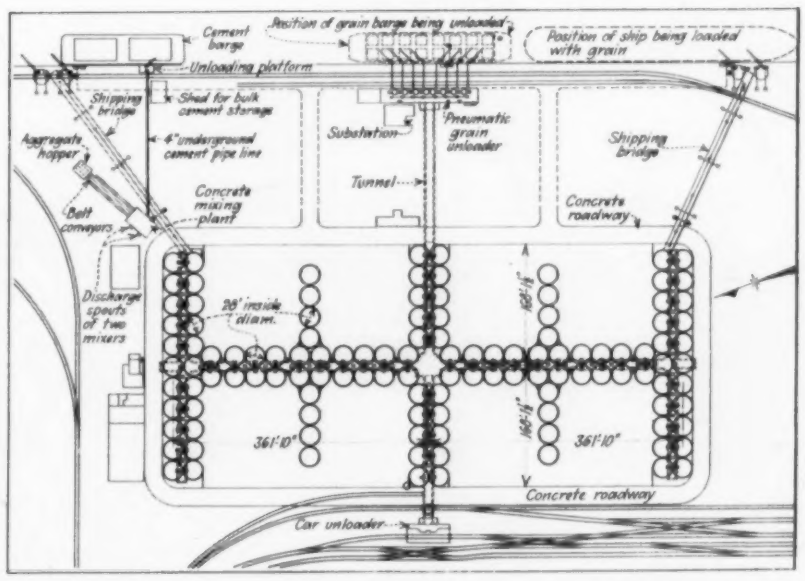
JACK BLOCK consists of horizontal saddle plate and two vertical arms attached to slip forms. Hollow screw on jack rod turns in threaded collar of horizontal plate. Two-nut collar on jack rod is raised and set at base of hollow screw to afford bearing for screw in raising forms.

Hudson River to vessels of 27-ft. draft from New York City to Albany, a distance of 143 mi.

Layout of Circular Bins. The elevator unit covers a plot about 750x335 ft. in area. Circular concrete bins, each of which is 28 ft. in inside diameter and 97 ft. high, are distributed in double rows, as indicated by the accompanying plan. Three of these double rows extend in transverse, or east-and-west, direction at each end and at the center of the area. Connecting these transverse double rows is another double row on the longitudinal center line of the plot. In addition to the 104 bins in these double rows, there are sixteen circular bins which form partitions in the large spaces. These latter bins are stepped down to conform with the slope of the roof over the commodity bins, decreasing in height from 97 ft. at the upper edge to 30 ft. at the lower edge.

Construction Plan. It will be noted that the double rows of 97-ft. tanks readily fall into five groups of about twenty each. The contractor determined to build the bins in these natural groups of about twenty each and to place concrete at the greatest practicable speed—about 9 in. an hour—with forms of conventional 4-ft. depth. Total concrete requirements for a group of tanks amounted to about 7,500 yd., and the desired speed of construction made it necessary to provide a concrete plant with a capacity of 60 to 65 yd. an hour.

Because of the large volume of cement required, 85,000 bbl., and because of the rapid consumption of this cement, it was decided to utilize bulk cement shipped in barges and unloaded by a conveying system. Adoption of this plan meant that little storage was necessary, as cement could be pumped from the barge to the plant as rapidly as



LAYOUT OF CIRCULAR CONCRETE BINS. Bulk-cement conveying system unloads material from barges and delivers it by 4-in. underground pipe and riser to elevated bins of central mixing plant.

needed. Aggregates were purchased from local supply companies and were delivered by trucks to the mixing plant as required. No job storage of aggregates was provided except in the bins of the mixing plant.

Foundations—About 10 ft. of hydraulic fill had been pumped in to raise the level of the ground on which the grain elevator rests. Under the hydraulic fill layer are strata of loam, sand and clay to a depth of 106 ft. below the surface where blue shale rock is encountered. A total of 7,380 creosoted piles, 30 and 35 ft. in length, were driven and cut off to carry the storage bins. Under the tunnels, or conveyor ways, where the piles were cut off below the level of the groundwater table, 2,800 untreated timber piles were installed. The Horton Construction Co., of Buffalo, was sub-contractor for the piling.

From 93 to 94 piles were installed under each of the circular storage bins. The piles were capped with concrete mats 2½ to 2¾ ft. thick, the concrete being distributed from the central mixing plant by Ford trucks equipped with hopper-bodies. Ramps were constructed to enable the trucks to chute concrete over a fairly wide area of foundation.

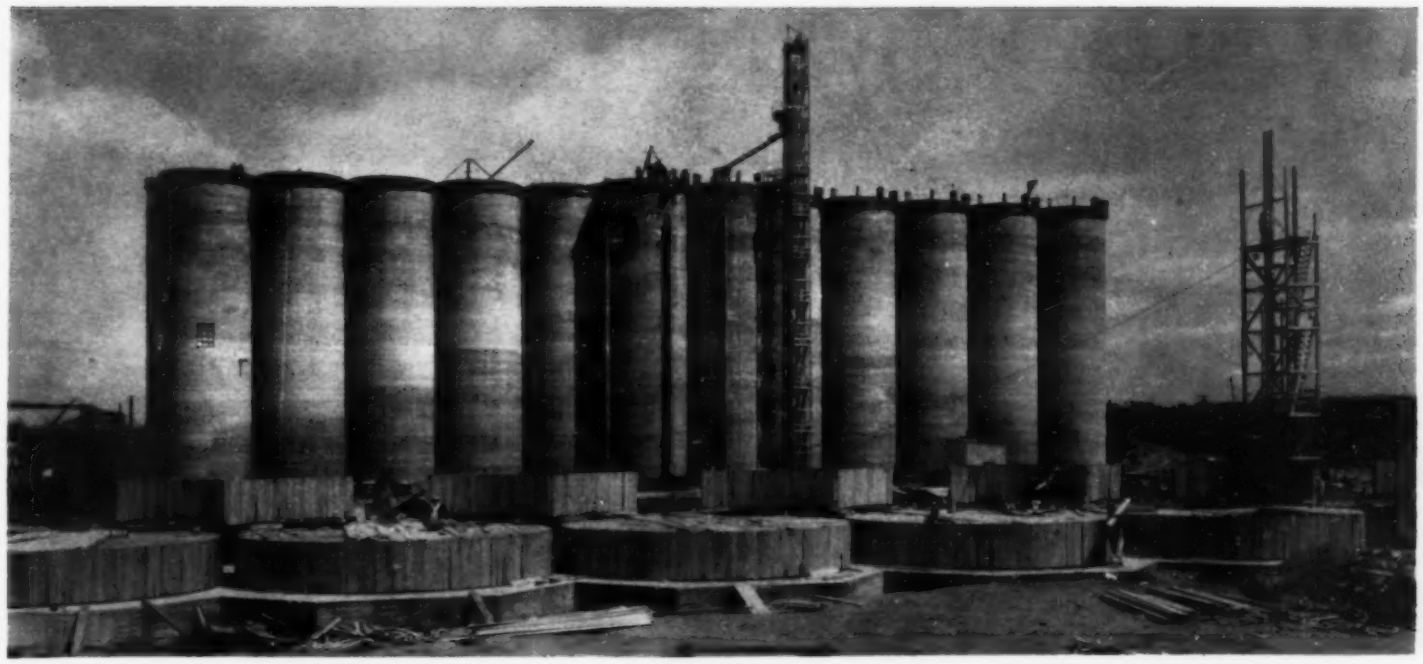
Slip Forms—A crew of carpenters and mechanics built the forms for the circular bins while the foundations were being constructed. The forms, 4 ft. in height, were made up of vertical pieces of 1x4-in. tongue-and-groove maple flooring which had been given a paraffin bath. At the top and bottom of the form, the lagging was attached to 6x8-in. laminated wales made up of three 2x8-in. boards. Diagonal studs between the wales further stiffened the form, the wales and studs together forming a truss, as can be seen in the photographs. The inside and outside forms for a circular bin were attached to eleven steel jack blocks which completed the slip form unit.

DOUBLE ROW of circular bins is concreted in one continuous operation, floodlights in dishpan reflectors on working platforms providing night illumination. Stiff-leg derrick being erected on platform will handle reinforcing steel for entire group of tanks.

A jack block consisted of a horizontal saddle plate and two vertical 6-in. channels. The channels carried brackets which were attached to the wales of the studding trusses. Two transverse steel trusses, designed to support the working platform during construction and the roof slab later, rested on the wales of the inside forms. To prevent binding, the form surfaces were given a slight pitch, the distance between the inside and outside forms being ⅜ in. greater at the bottom than at the top. The walls of the circular bins were 7 in. thick.

Raising Forms—Forms were supported at the jack blocks on two-nut collars secured by set screws to 1-in. round vertical jack rods (in the wall

TWO STAGES of circular-bin construction. In background is group of tanks, rising rapidly under continuous placing of concrete by hand carts distributing from floor hopper on working platform. In foreground, slip forms of standard 4-ft. height, are being constructed for erection of next group of tanks.



TOWER BUCKET ELEVATOR delivers concrete from hopper-body trucks to working platform for construction of group of tanks 97 ft. high. Tower for next group of tanks is being erected at right.

of the circular bin) which were continuous from the base. The horizontal saddle plate of each jack block carried a threaded collar in which turned a hollow screw fitting over the jack rod, and the lower end of the hollow screw rested on the two-nut collar secured to the jack rod, thus supporting the entire assembly. Workmen raised the form by turning the hollow screw in clockwise direction. To facilitate this operation, the screw was equipped with a head which provided for insertion of a hand lever. The screw had a 15-in. run. At the end of this run, while the form was supported by the ten other jack blocks, the screw was turned in reverse direction to raise it to the top of its run, and the two-nut collar was moved up 15 in. and secured in its new position. The block then was ready for another 15-in. rise.

Jack rods, which came in 18-ft. lengths, were spliced by pipe nipples about 1 ft. long crimped at the center. At each splice the pipe nipple held the new length of rod directly on top of the rod below, thus transmitting the vertical load through a continuous rod to the bottom of the circular bin. Horizonal reinforcing steel for the wall of the circular bin was tied to the jack rods; and vertical reinforcement was attached to the horizontal.

One man took care of turning the jack screws in proper sequence at eighteen jack blocks. Five men on each shift raised the jack screws and two-nut collars of the jack blocks on all the bins in a group under construction at one time. The walls of the circular bins were maintained plumb during construction by keeping the forms and working platforms level.

Concrete Plant—Total concrete requirements amounted to 70,000 yd. A convenient location was selected for the central mixing plant close to the bins at one corner of the grain elevator, clear of all construction operations and about 300 ft. from the wharf wall along the river. The contractor installed a Fuller-Kinyon bulk-cement pumping and conveying system to unload both barges and box cars. Bargeloads of cement were used exclusively for the large quantities involved in the principal items of construction. As indicated by the accompanying job layout, a railroad track runs parallel with the wharf wall. A small unloading platform was built between the track and the wall, and a pipe line 4 in. in diameter and 387 ft. long was laid underground to convey cement from the platform to the mixing plant. A shed for 1,200-bbl. cement storage was provided close to the platform, but cement usually was pumped directly from the barge to the 200-bbl. cement hopper at the mixing plant. One Fuller-Kinyon pump handled all the cement from both barges and box cars, 85,000 bbl. in all.

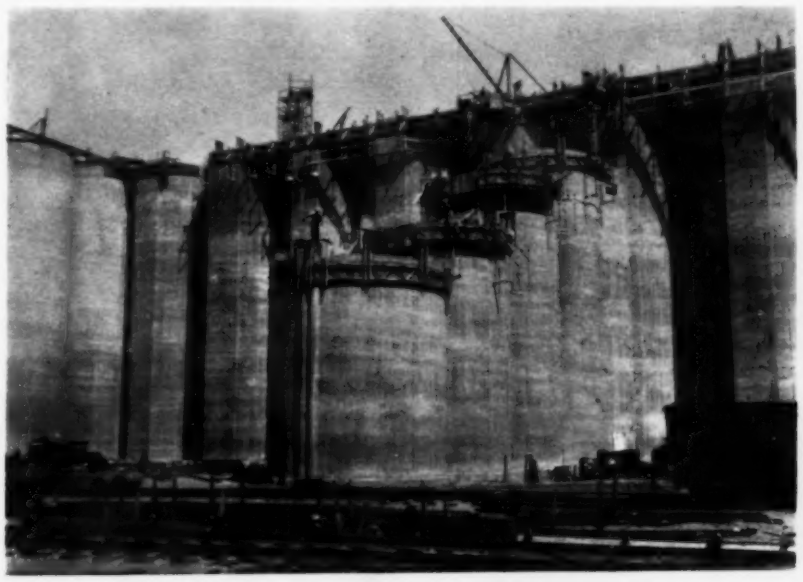
Sand and gravel were delivered and dumped by dealers' trucks into concrete hoppers at the lower end of two long belt conveyors which elevated the aggregates to bins above the mixers. The contractor built the bins for all concrete ingredients and volume batchers for the aggregates. Cement was weighed on a platform scale. Two Smith 1-yd. tilting mixers mixed the concrete and discharged it into hopper bodies of trucks spotted alongside the plant. All the material-handling and mixin equipment was electrically driven.

Concrete Distribution — Concrete batches were hauled by hopper-body trucks to a wood tower hoist serving the group of bins under construction. The tower bucket elevated the concrete to a hopper which chuted it to a floor hopper on the working platforms. Hand carts distributed the concrete from the floor hopper to the forms. A stiff-leg derrick on the working platforms went up with the forms and handled the reinforcing steel for the entire group of tanks. Floodlights on the working platforms provided illumination for night operations.

Progress—Three shifts per day were employed to carry on continuous placing of concrete in the walls of the circular bins. The contractor obtained a general average progress for all the bins of 17 ft. every 24 hr., or 8½-in. an hour. On the last group of bins, this rate of construction was greatly exceeded, the walls being carried up to a full height of 97 ft. in 5 days, for an average of over 19 ft. a day.

Supervision—Arnold G. Chapman, chief engineer, and R. L. Holt, construction engineer, were in charge of the project for the Albany Port District Commission. The grain elevator was designed and constructed by the James Stewart Corp., of Chicago, under the general direction of H. G. Onstad, vice-president. Paul C. Metz was resident superintendent in direct charge of construction.

A lease for 10,000,000-bu. storage capacity at the grain elevator has been taken by the Cargill Grain Co., Minneapolis, Minn. M. Marshall, superintendent, represented the lessee during construction and supervised the installation of equipment.



PARTITION BINS dividing storage space under suspended steel-plate roof are stepped in height to conform roughly with roof slope.

NEXT MONTH—A second article will describe the construction of the suspended, welded steel roof at the Albany grain elevator.

WELDED JOINTS

Reduce Friction Losses in San Francisquito Steel Penstock

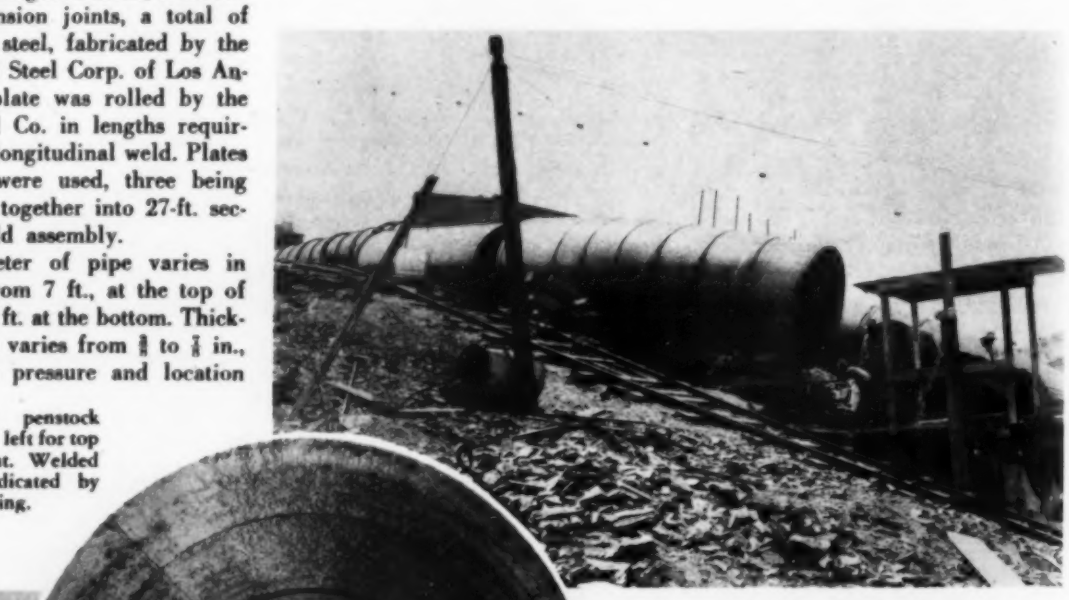
ELECTRIC-ARC welding was employed both in the shop and in the field for fabricating and installing the 6- to 7-ft. diameter steel penstock which serves the third 17,500-kva. hydro-electric generating unit of San Francisquito plant No. 2, placed in operation last October by the Bureau of Power and Light of the Los Angeles Department of Water and Power. The new pipe line, described by Clayton M. Allen, junior electrical engineer of the Los Angeles Bureau of Power and Light, in a paper before the Los Angeles Section of the American Welding Society, the source of the following notes, is 1,400 ft. long, parallels two existing riveted penstocks and carries water to one of three turbines operating under a static head of 530 ft. It is the first rivetless, all-electric-arc-welded steel penstock in the United States.

Alternate Specifications—Specifications provided for receiving bids on both riveted and shielded-arc-welded steel pipe. While the prices submitted indicated that the shop fabrication of the welded pipe would cost 13 per cent more than the riveted design, the saving in cost of installing the welded penstock would more than offset the increased fabrication cost. In addition, increased efficiency for the welded pipe, due to reduction in friction loss by elimination of rivets and butt straps, was calculated to result in a large return over a period of years because of increased output. These considerations led the Bureau's engineers to recommend and purchase the welded penstock.

The complete penstock line consists of 40 straight sections, 9 elbows and 2 expansion joints, a total of 309 tons of steel, fabricated by the Consolidated Steel Corp. of Los Angeles. All plate was rolled by the Lukens Steel Co. in lengths requiring but one longitudinal weld. Plates 9 ft. wide were used, three being shop-welded together into 27-ft. sections for field assembly.

The diameter of pipe varies in 3-in. steps from 7 ft., at the top of the line, to 6 ft. at the bottom. Thickness of plate varies from $\frac{3}{8}$ to $\frac{7}{8}$ in., according to pressure and location in the line. Of the total line, 900 ft., or 64 per cent, is of $\frac{3}{4}$-in. plate, 7 ft. in diameter. The nine elbows in the line turned horizontal angles of from 3 to 26 deg. and vertical angles of from 3 to 22 deg. There were four compound angle elbows. Changes in pipe diameters were accomplished by short tapered sections.

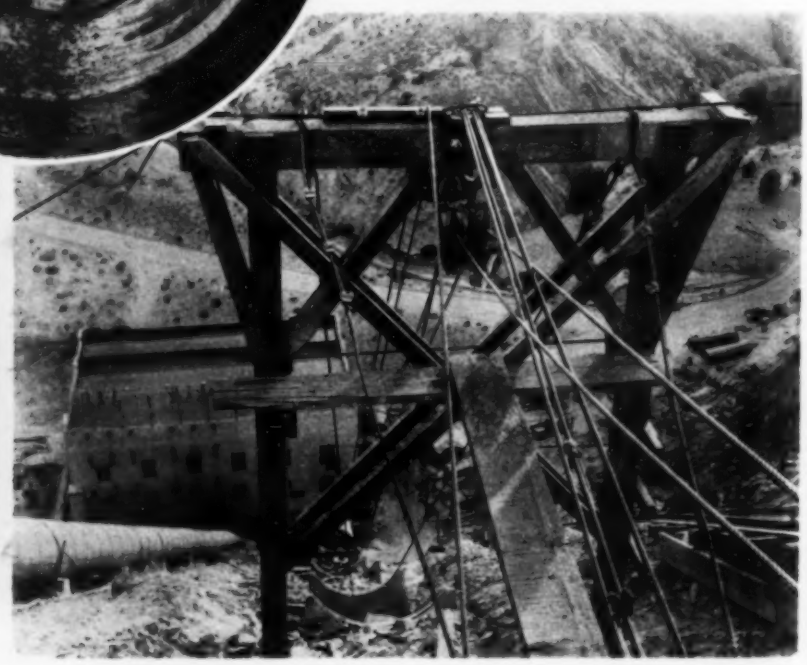
Shop Welding—All longitudinal joints were butt-welded in the shop by specially built machines, designed by engineers of the fabricating company, using the carbon-arc "Tornado" of the Lincoln Electric Co. A special round-seam welder, also developed by the fabricating company, was used on the inside circumferen-



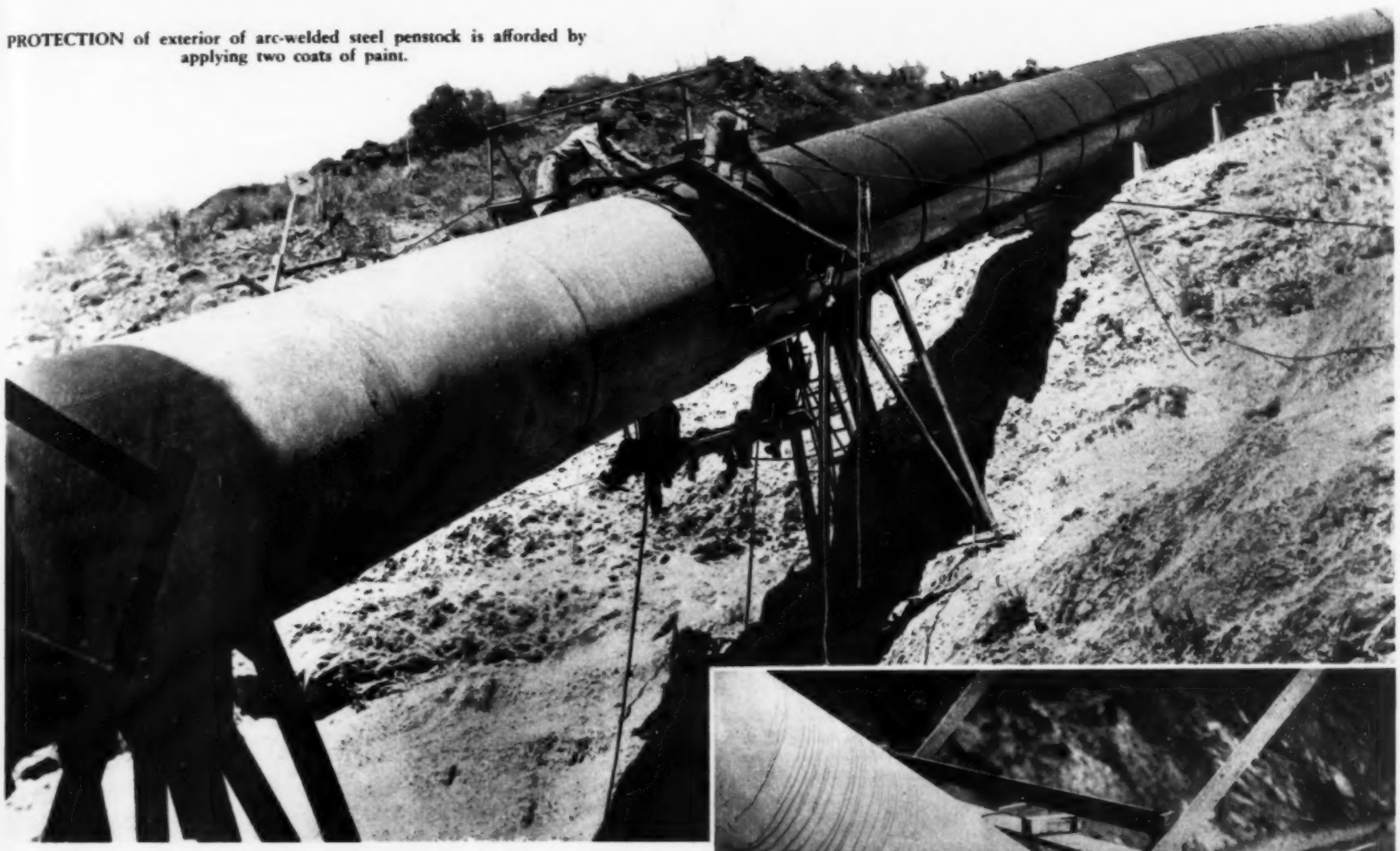
ONE OF THE ELBOWS of the rivetless steel penstock being set preparatory to concreting.

INSIDE of penstock above opening left for top expansion joint. Welded field joint indicated by black ring.

FOR HANDLING *(below)* pipe sections, each about 27 ft. long, a system of cables and hoists was used on slopes as steep as 42 deg. with the horizontal.



STEEP SLOPE of hillside above San Francisquito hydro-electric plant makes construction of big welded steel penstock difficult.



PROTECTION of exterior of arc-welded steel penstock is afforded by applying two coats of paint.

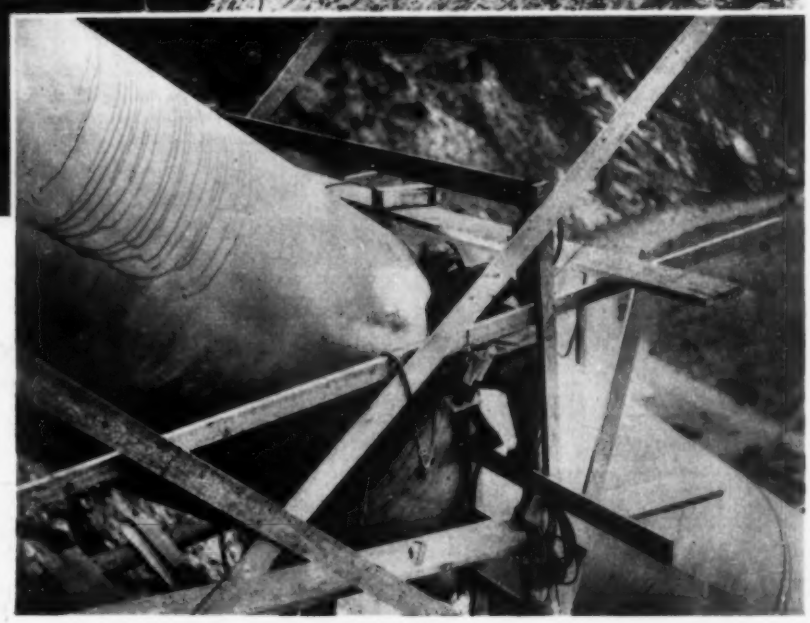
tial joints. The outside welds were made by hand, using ¼-in. Fleetweld electrodes.

A novel inclined structural steel rack was designed and used on the outside hand lap welds. The pipe sections were put on this rack and by means of motor-driven rollers were slowly rotated so that welders sitting on horizontal platforms could weld with the work always in the flat position. Three welders could work at once, one to a plate on 3-plate sections.

The circumferential joint selected was of the coupling type, employing a butt-strap. The ends of the two sections to be joined were turned to a 2-deg. taper on the outside for a distance of 4 in. and beveled on the edge to an angle of 30 deg. An outside butt-strap 8 in. wide and of the same thickness as the plate was taper-turned on the inside to fit the ends of the pipe. When the sections were brought to within ¼ in. of each other, a welding "V" was formed with ⅛-in. straight sides and the remainder beveled, leaving a 60-deg. angle to be filled with weld metal. Taking into account the bevel, the result was that the thickness of metal in butt welds inside and lap welds outside was in every case ⅛ in. less than the plate thickness. In each piece, whether elbow or straight section, the shop welding was completed with the butt strap for the field joint on the upstream end, thus facilitating erection and field welding.

The final procedure in welding the shop joints was to tack-weld the inside butt joint and one outside lap joint, and then finish the butt and lap welds in that order so that locked-up stresses might be reduced to a minimum. Next, the closing outside lap joint was welded.

In the different types of welding on various thicknesses of plate the number of passes or layers was of interest. The machine welds on the ⅜-in. plate were made in two passes, one outside and one inside. On the same weld of greater plate thickness the number of passes ran as high as four on the outside and one inside. On the inside round-seam machine welding the number of layers varied from two to three, according to plate thickness.



LAP WELD is made from outside of pipe at field joint.

Joint Tests—A unique method was used to test the finished welded joint for the segregation of leaks between the butt or lap weld. Holes ¼ in. in diameter were drilled through the butt strap of each shop joint from

PEEN-HAMMERING of each bead of field weld is done by a lightweight air hammer.

WELDING MACHINES are supported on specially built platforms on hillside with 42-deg. slope.

the outside, one on each side of the butt weld. This allowed a high pressure soap test to be applied on each lap weld and two tests on the butt weld. The advantage of this method over the pressure test from the inside of the pipe is readily seen in that the butt weld may have had a small pin-hole leak which would not appear on the outside through lap welds in which there were no leaks.

After each section successfully passed all tests, it was subjected to the final fit with the adjacent section. This was extremely important, for a misfit on a 10-ton piece of pipe high up on the side of a hill at an angle with the horizontal of 42 deg. would be rather difficult to rectify in the field.

Penstock Erection—The erection of the penstock was piece by piece from bottom to top. The assembly was handled from three points, as there were two expansion joints in the line and a concrete anchor at the brow of the hill, making logical construction sections. The start was made on the ¾-in. sections at the bottom and a short time later work was started in two places on the ⅝-in. sections.

INSTALLATION of one of the two expansion joints in the all-electric arc-welded steel penstock.

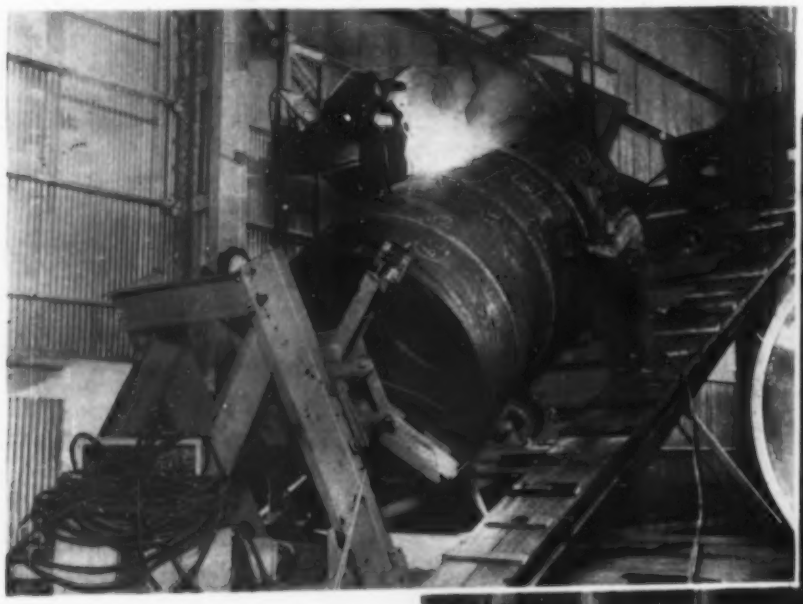
The welding procedure on each joint was to put in about a half dozen heavy tacks equidistant about the circumference of the inside butt weld and then to proceed with the welding, trying to keep approximately the same number of beads on every part of the periphery. This, of course, had to be varied due to the extreme inconvenience of trying to work on a small level platform inside or upon scaffolding outside with the pipe at a steep angle with the horizontal.

With the inside butt weld completed, the outside lap weld was next completed. Often the next section was ready for installation and rather than hold up the work it was placed and welded on the inside before the previous outside lap weld had been finished.

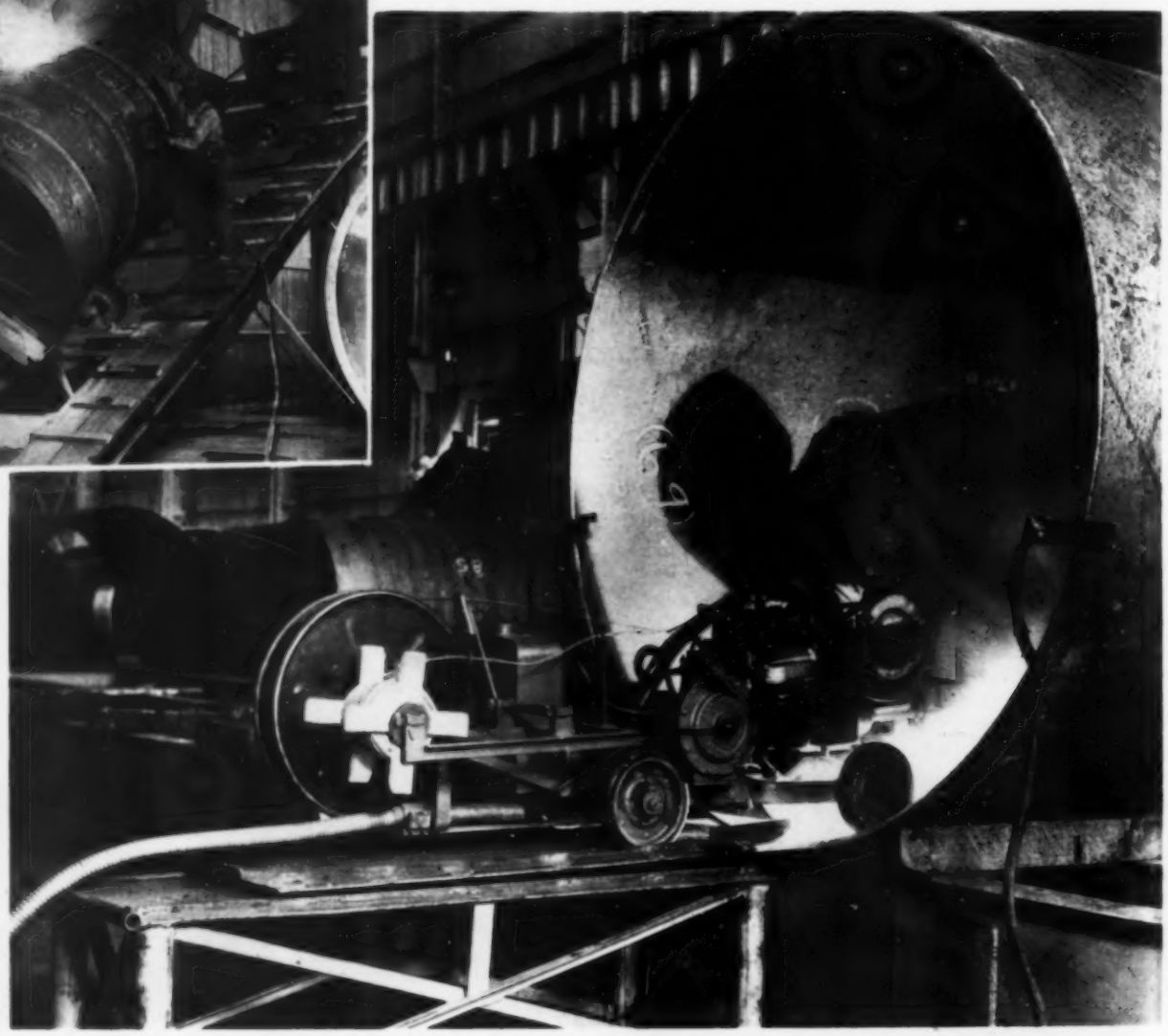
A welding crew consisted of a welder and a helper. The helper was kept busy, as his duties included the cleaning and peen-hammering of each bead and keeping the welder supplied with all the necessities, such as rod, water and electric lights. There was a maximum of eight welders on the job. Seven worked at welding, one welder being used as a straw boss on part of the work, and one with the erection gang most of the time. Welding operations started June 20, and on August 22 the penstock was filled without a leak.

Previous to erection and welding all sections were sand-blasted and painted inside with bitumastic enamel supplied by the Wailes-Dove-Hermiston Co. After the line had been filled, the outside surface was given a two-coat job of graphite paint supplied by the Detroit Graphite Co.

The work was done by the Los Angeles Bureau of Power and Light, under the direction of Dr. E. F. Scattergood, chief electrical engineer and general manager.



INCLINED STEEL RACK *(above)* with motor-driven rollers rotates pipe so that operators can weld from on top.



TRAVELING CARRIAGE carries welding equipment for making longitudinal joints of penstock sections in shop.

It was decided to do most of the welding at night to eliminate possible difficulties from temperature changes in the pipe. Also, on the steep part of the hill, a 42-deg. slope, it would have been impossible for welding crews to work at the same time as the erection crew, due to the hazard of falling and rolling rocks.

The ideal program was to erect and tack-weld a section in the day time and start welding at about sundown, in order to get in two 8-hr. shifts before erection of the adjacent piece the next day. This program was carried out on the steeper part of the hill.

JOB ODDITIES

A Monthly Page of Unusual Features of Construction

THIRTY-TON ROCK is delivered from quarry by motor truck for use in San Gabriel No. 2 dam, California, a rockfill structure 360 ft. high, containing 5,000,000 cu.yd. of fill. Thirty per cent of the fill must consist of rocks weighing more than 3,000 lb. The dam is being built for the Los Angeles Flood Control District by Macco-Lewis, Inc., of Los Angeles.

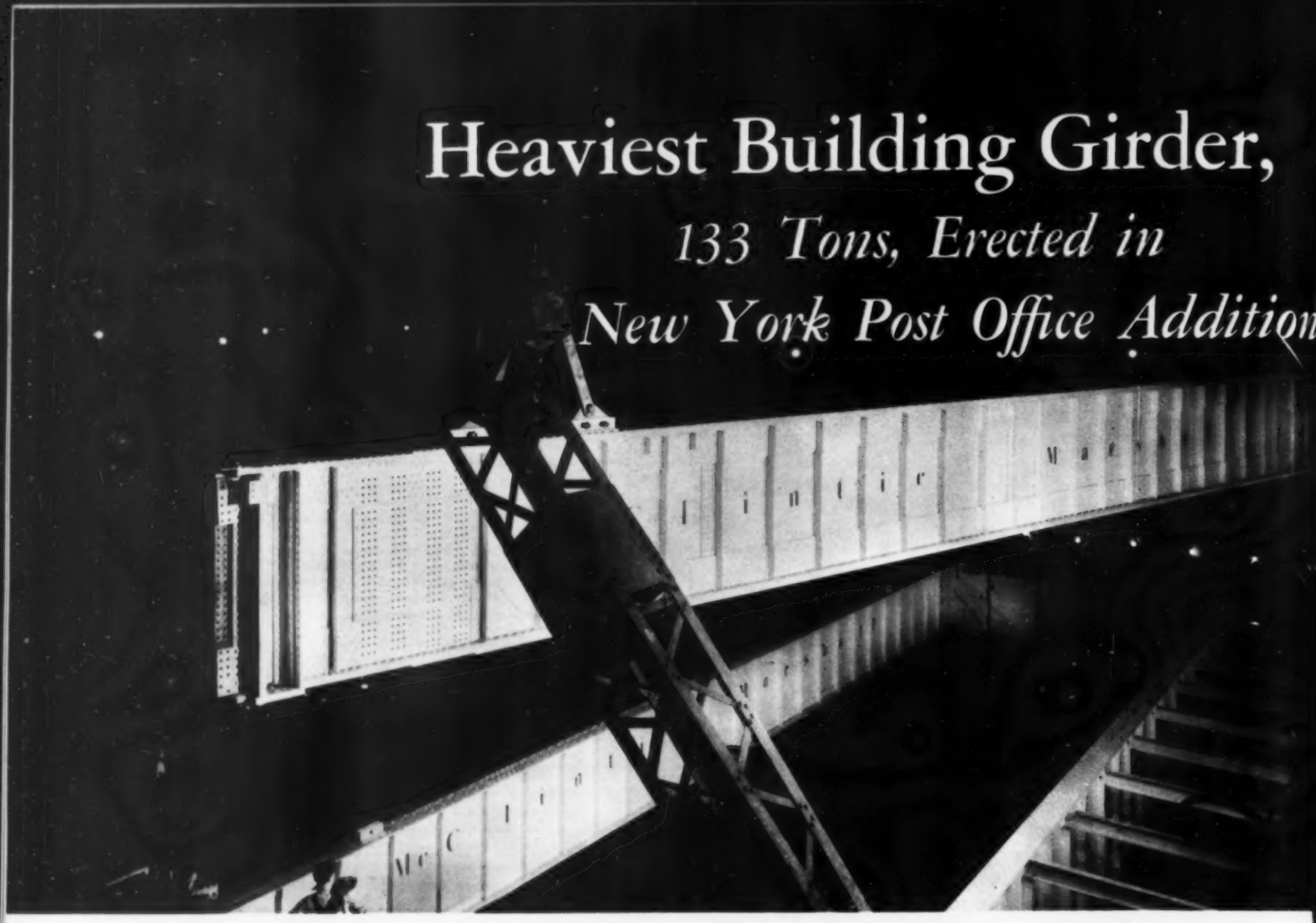
CONCRETE PYLONS, with precast figures, form ornamentation for Lorain-Carnegie bridge, Cleveland, Ohio. Note truck-mounted concrete mixer in hands of figure symbolizing construction.

WEIGHT TEST in form of team of heavy Percherons, is applied to floor of 18-gage Armco sheet metal in newly erected frameless steel house of pre-fabricated units at Solon, Ohio.

OLD AND NEW METHODS OF ROAD MAINTENANCE. In Palestine *(left)* mule, loaded with brush, serves as "drag" to smooth surface. Scraper *(right)*, mounted under FWD motor truck, does a better and a quicker job.

Heaviest Building Girder,

133 Tons, Erected in New York Post Office Addition



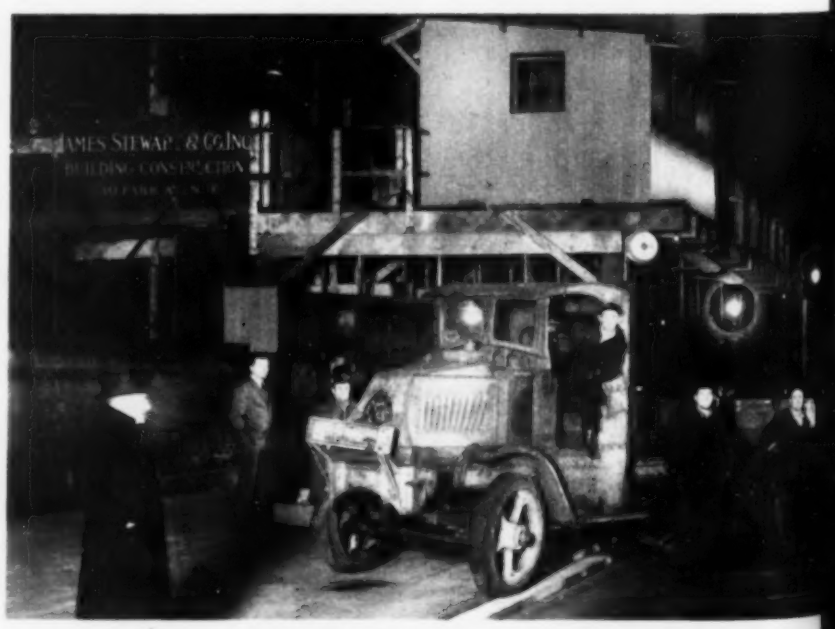
LONG, SHOP-FABRICATED PLATE GIRDERS spanning electrified main-line tracks of passenger terminal can be erected only during three brief periods of third shift, between midnight and 8:00 a.m. Two 85-ton derricks handle girders weighing up to 133 tons.

UNUSUALLY hazardous and difficult operations are involved in the construction of the substructure for the New York Post Office addition over the electrified tracks of the Pennsylvania Railroad passenger terminal in New York City. James Stewart & Co., Inc., which holds the general contract for the substructure, has had extensive experience in air-rights construction over electrified tracks, the company's most notable work of this kind up to the present having been that on the New York Central right-of-way from Grand Central terminal north along Park Avenue, New York City, completed 4 years ago. On no previous project, however, has the contractor encountered conditions as difficult as those at the Post Office addition, where numerous track cross-overs made irregular and crowded pier locations necessary and where high-voltage catenary wires, recently installed, add to the hazards of the original third-rail electrification system. Thoughtful preliminary planning and vigilant supervision had succeeded in preventing, up to the time these notes were written, any injury to workmen or delay to train movements.

Construction Hazards — Locomotive movements through the construction area total 900 per day, including more than 500 incoming and outgoing passenger trains. Until recently, power for all locomotive movements at the terminal was taken from the third-rail system, which supplies 650-v. d.c. current. During 1932, a system of overhead trolley wires carrying 11,000-v. a.c. current was installed in connection with the electrification of the Pennsylvania main line from New York to Philadelphia and Washington. Electric locomotives taking power from these overhead catenary wires now operate daily in and out of the terminal to points in New Jersey. A total of 40 terminal tracks pass through the construction site. About half of these, in the center of the area, serve as main-line tracks for inbound and outbound trains. The remaining tracks, distributed on the two sides of the terminal, are used principally as storage tracks. All these tracks are in a rock cut about 70 ft. below street level.

Because of the active operation of the terminal, it is impossible to use the railroad facilities for delivery of materials and removal of spoil. All material movements must be by way of the street, with tower hoists for delivery between the two levels.

Close spacing of tracks and third rails made primitive methods necessary in handling foundation materials. All spoil excavated from 206 foundation piers was carried to the tower hoists in canvas bags on the shoulders of workmen. Gallows frames used in hoisting the spoil by buckets from the pier excavations were removed at the end of each shift. Cement and aggregate for most



EXPERT MANEUVERING by skilled truckmen takes girders up to 116 ft. long across 9th Ave. and turns them through 90 deg. between columns of elevated railway structure. Girder is mounted on two trailer trucks designed

116-FT. GIRDER WEIGHING 133 TONS is placed in vertical position on two sixteen-wheel trailer trucks at railroad yard preparatory to trip to building site. Eight dual wheels of each truck are mounted on rocker axles which permit truck to ride over curbs and other uneven surfaces with load equally distributed on all wheels.

of the concrete in the foundation piers were carried by workmen to a ½-sack mixer which could be set up in the narrow space between two tracks. Where greater space was available, a 1-sack mixer was used for this work.

Safety Measures—Extreme caution and elaborate protective measures enable the contractor to carry on construction operations without accidents. The engineering department of the railroad company cooperates in the protection of workmen and railroad structures and in the shoring of trackage. Flagmen, third-rail men, catenary men and signal men are provided in sufficient numbers to assure safe execution of all operations. Steel erection is permitted only at certain specified periods, and heavy girders over the main-line tracks can be placed only during three periods in the third shift, between midnight and 8 a.m., when power is cut off in the catenaries and third rails to protect the property and the workmen. Every column of the structure is grounded by the railroad company electricians to dissipate any induced current from the high-tension catenary wires. Before starting riveting and fireproofing of the girders, the contractor hangs a suspended plank floor from the structural framing to protect completely the tracks and wires below.

Dimensions of Building—The post-office addition is being erected on the west half of a two-block plot bounded by 8th and 9th Aves., 31st and 33rd Sts., the east half of which is occupied by the present post office. Plan dimensions of the new building are 419x454 ft. The addition conforms in design with the existing post office, and the basement floor, included in the present contract, connects with the basement of the post office under a driveway running from 31st to 33d Streets between the two buildings.

Construction Program — Operations are planned to avoid interference with train movements. The contractor usually employs two shifts, although three shifts often are engaged in prosecuting the work throughout the 24 hr. of a day. An effective system of lighting with Crouse-Hinds floodlights illuminates the job at night. The project was divided for construction purposes into north and south halves, with a hoist tower for each half on the 9th Ave. side of the plot to handle materials.

GIRDER is delivered to sidewalk on 9th Ave. parallel with its final position in structure. Hitching bars pinned to 8-ton overhauling weights of 85-ton derricks are bolted to shop-riveted hitch angles on top flange of girder.

WILLIAM J. BIGLEY, JR., of Bigley Bros., Inc., directs trucking of structural steel.

Foundation piers on the 9th Ave. side of the site were completed first to permit erection of steel to start from this end. Steel girders are delivered by trucks to the sidewalk on 9th Ave. As soon as steel erection had proceeded far enough, the contractor hung sections of the suspended plank floor to permit riveting and fireproofing of the frame.

Steel Erection—Structural steel is being fabricated and erected by the McClintic-Marshall Corp. under subcontract. Erection operations are hampered by the restrictions on working time and by the irregular design of the steel framing. Girders over the main-line tracks can be erected only in three intervals of the third shift: 1:10 to 1:40; 2:16 to 3:00; and 4:00 to 4:36 a.m. One of the girders spanning the main-line tracks is believed to be the largest and heaviest ever fabricated for a building and erected as a single built-up unit. Apparently this girder is the largest and heaviest ever transported through the streets of New York City. Measuring 115 ft. 10 in. long and 9 ft. 2 in. deep, the member weighed 133 tons.

Complicated framing, resulting from the irregular spacing of the columns, imposed certain difficulties in erection. Girders frequently are framed at one end or at both ends into girders which in turn tie into other girders. This involved design of the frame makes it necessary to erect the final supporting girder resting directly on columns before the intermediate members can be set, and it also requires precise work on the part of two derricks in setting closing members into position with practically no clearances available for vertical or horizontal displacement during erection.

Erection was begun by crawler-mounted cranes working from the

on fifth-wheel principle which makes it possible to steer long girder in same manner as hook-and-ladder fire truck. Adjustable steel brackets and turnbuckle ties pinned to bolsters anchor girder securely in vertical position.

J. C. C. FISHER (*left*), chief inspector for Pennsylvania R.R. Co., and L. R. MILLER, assistant superintendent, James Stewart & Co., Inc.

street and is being carried on principally by six steel stiff-leg derricks which were set up on the basement floor framing as the work progressed. According to the steel erector's plan, the job is laid out into 23 working areas, requiring twelve derrick set-ups and eleven sliding moves. Steel is shipped in the order of erection from the Pottstown and Bethlehem, Pa., plants of the McClintic-Marshall Corp., and is marked for the proper derrick area. Members weighing more than 20 tons are delivered by rail to a freight yard on 12th Ave. between 35th and 37th Sts., about 4,000 ft. from the building site.

Trucking Girders—One of the most difficult problems involved in handling the steel was that of transporting long, heavy girders through the city streets from the freight yard to the site. This difficulty was greatly increased by the presence of an elevated railway structure on 9th Avenue.

Bigley Bros., Inc., of Hoboken, N. J., had previously hauled for the McClintic-Marshall Corp. girders to be used in the West Side elevated express highway in New York City. To haul these girders, Bigley Bros. had developed special sixteen-wheel trucks with the wheels mounted on rocker axles which enabled each wheel to carry its full share of the load no matter how uneven the rolling surface. For this work, also, the hauling contractor had instituted the practice of transporting the girders with webs vertical instead of horizontal. As a result of the firm's success on the previous hauling work, it was given the contract for transporting the heavy girders to the post-office addition.

SHEAVE BLOCK for thirteen-part hoisting falls on 85-ton derrick has shaft bored and counter-bored for pressure-gun lubrication. Hitching bars are used instead of wire rope in lifting heavy girders.

Erection of the heavy girders in the short working periods available made it necessary that each girder be delivered to the sidewalk on 9th Ave. between 31st and 33d Sts. To put the girders in this position, the hauling contractor had to take them across 9th Avenue between the columns of the elevated structure and, as part of the same operation, to turn them from an east and west direction to a north and south direction. A cardboard model of the elevated crossing was constructed to ½-in. scale to study the possibility of making this 90-deg. turn. As a final test, a wood model 116 ft. long was constructed of two spliced 100-ft. timber sticks and was hauled through the streets at night. These tests showed that the long steel girders could be successfully handled between the columns of the elevated structure.

Girders are transported individually on two sixteen-wheel trailer trucks and are fastened securely on the trucks for hauling by adjustable steel brackets and turnbuckle ties, as indicated by one of the accompanying photographs. Both of the trailer trucks are constructed on the fifth-wheel principle to give greater flexibility in making turns. An upper plate carrying the bolsters is attached to a 10-in. king pin which permits rotation on the greased surface of a lower plate forming part of the chassis. Two motor trucks are sufficient to keep the heaviest girders moving on the level. One of these motor trucks pulls directly in front of the forward truck, and the second motor truck is attached to the rear of the second trailer to assist in steering the long girders around corners and between columns.

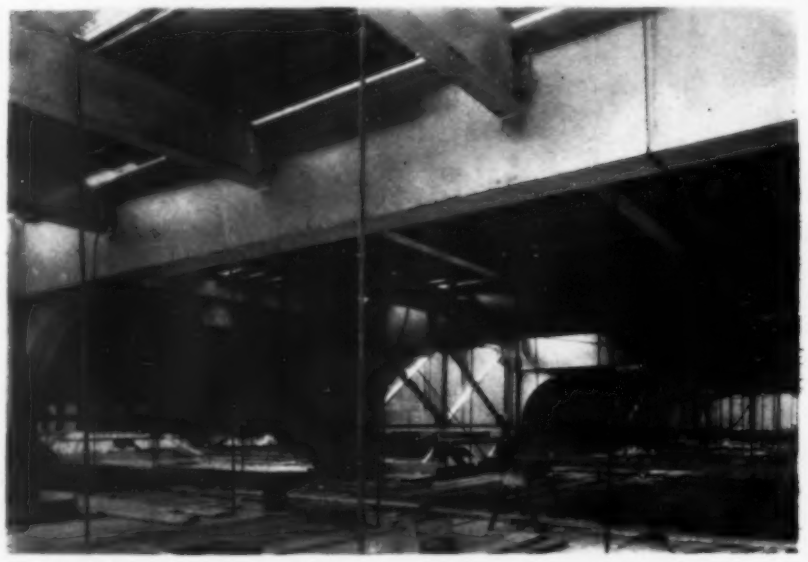
Seven motor trucks were required to pull the 133-ton girder up a grade on 31st St. One of the extra trucks was placed in tandem with the forward motor truck, and the others were attached by hauling lines to shackles on the trailer trucks as required.

Each girder is blocked up on the trailer trucks to clear fire hydrants at the turns. This blocking leaves a clearance of only 2½ in. between the upper flanges of the deepest girders and the elevated structure. The longest girders have a clearance of only 1 in. in passing between columns of the elevated railway.

In starting the work, fourteen of the longest girders were hauled at night to avoid traffic tie-ups. Operations proceeded so smoothly and quickly that no traffic delays resulted, and later girders have been transported by day. The job requires 41 girders of greater than 60 tons weight, from 75 to 116 ft. long.

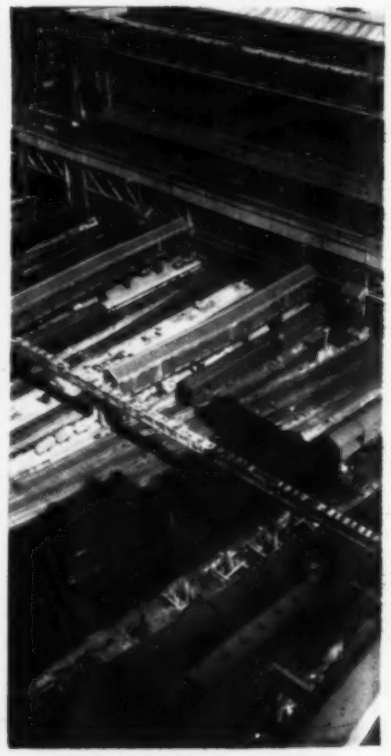
Erection Derricks—Six steel stiff-leg derricks are erecting practically all of the 11,600 tons of structural steel required for the substructure of the post-office addition. Three American stiff-leg derricks with 95-ft. booms are operated by Lambert three-drum hoisting engines driven by Western Electric 150-hp. motors and have capacities of 85 tons each. These derricks are equipped for swinging with Mundy two-drum hoists driven by General Electric 20-hp. motors. Two of the 85-ton derricks handle the heavy girders spanning the main-line tracks.

As a protection against accidents in steel erection, the derricks are equipped with automatic safety brakes which are similar in function to the dead-man control in electric



PLANK FLOOR suspended from steel frame protects tracks and electrical conductors below, permitting riveting and concreting to be carried on without danger to railroad structures.

LONG STEEL RODS suspended from I-beams or wood joists support plank floor. Note sleeve couplings below I-beams. Lower sections of rods will be screwed out of these sleeves after concrete floor has been completed.



40 ELECTRIFIED TRACKS of passenger terminal complicate construction of foundation piers, some of which are being excavated in foreground. Post office addition conforms in design with existing post office, which appears on far side of driveway.

railway cars and locomotives. The safety brakes are applied by heavy compression springs and are held in released position by G.E. thrusters which overcome the force of the springs as long as the thruster motors continue to operate. When running a derrick, the hoist operator keeps his foot on a pedal bar which closes a circuit supplying power to the thruster motors. At the instant his foot leaves the bar, the thruster motors cease to operate, and the compression springs apply the brakes, stopping the hoist immediately.

A further safeguard was added to the automatic brakes by the electricians on the job, who so wired the apparatus that the operator cannot start the hoist motor, after the automatic brakes have been applied, without first returning the control lever to neutral position. This feature saves the hoist and cables from danger of severe starting stress when a new man takes over the machine following collapse or injury of the regular operator of the equipment.

In addition to the three 85-ton derricks, the steel erector is using two 40-ton stiff-leg derricks having 91-ft. booms operated by Thomas three-drum electric hoists and one 60-ton stiff-leg derrick with 100-ft. boom operated by a Mundy three-drum hoist driven by a Waukesha 100-hp. gasoline motor. An auxiliary steel guy derrick is used for setting up stiff-leg derricks and for handling some of the structural steel. All hoisting cable is ⅞-in. Roebling blue-center wire rope.

Suspended Plank Floor—To protect the tracks and catenaries below, the contractor hangs a plank floor from the structural frame by means of long threaded rods. As illustrated by one of the photographs, these rods are supported at the upper end by bolted clamps on the flanges of I-beams or by plate washers resting on wood joists. At the lower end, the rods carry wood joists which support the plank flooring. The photograph shows sleeve couplings on the rods just below the I-beams. When the plank floor is removed, the lower section of the rod is screwed out of this sleeve, and the upper section of the rod is left extending from the concrete floor to serve later for erection of scaffolding if needed.

Fireproofing—Hollow tile is employed to protect the webs of the girders, as this material is lighter in weight than concrete. Bottom flanges of the girders are covered with 3 in. of concrete. Dayton beam hangers and simple nail-type spreaders are used to hold the bottom girder forms in position, as indicated by one of the photographs.

Concreting — Concrete requirements for the entire substructure amount to 9,000 yd. A subcontract for all concrete except that in the foundation piers was awarded to the Viaduct Construction Co., Inc., of New York City. The subcontractor is producing about 5,000 yd. at a 1-yd. mixing plant on the 33rd St. side of the job and will mix about 2,500 yd. at a ¾-yd. plant to be installed on the 31st St. side.

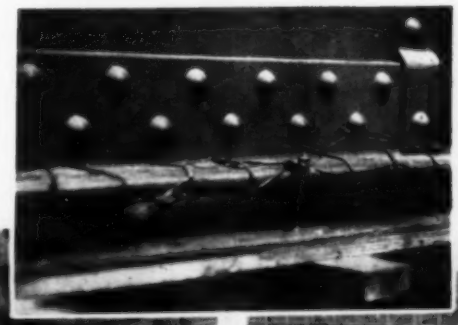
Spreading Work—About 600 men are employed each day on the project. To provide employment for a greater number, about 300 of this force work on alternate weeks, thus increasing the total number of men drawing wages on the job to more than 900.

Direction—Construction of the substructure of the New York Post-Office addition is under the general supervision of James A. Wetmore, supervising architect of the Treasury Department, Washington, D. C. E. F. O'Brien, construction engineer, is in direct charge of operations for the supervising architect, assisted by J. Friou, F. V. Deyerberg, and by S. M. Feinberg, who has charge of night work.

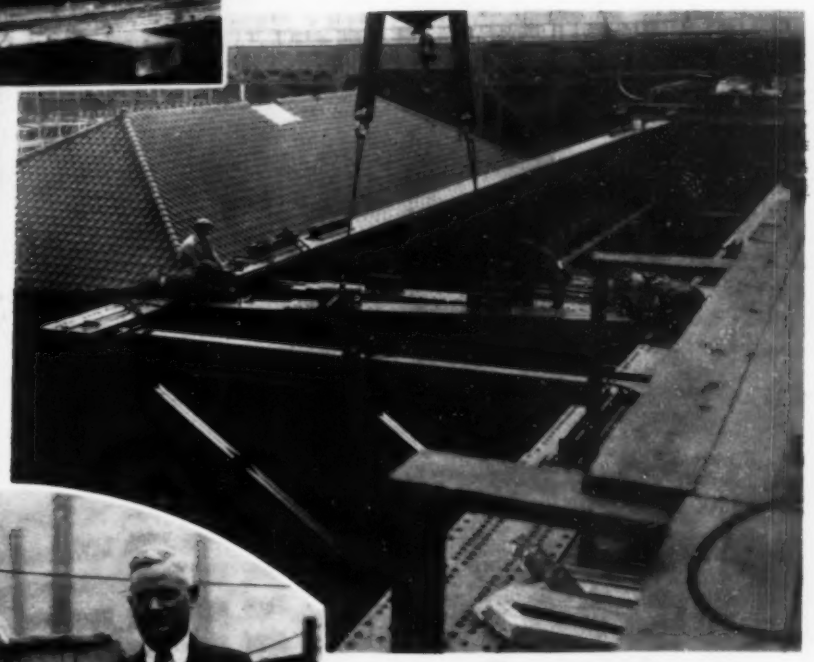
For James Stewart & Co., Inc., of New York City, Henry W. Lohmann, vice-president, and George N. Riker, chief engineer, have general supervision of construction, with A. L. Felio, general superintendent, and L. R. Miller and H. A. Williams, assistant superintendents, in charge of field operations. George C. Lane, engineer of erection, directs the work of the McClintic-Marshall Corp. The interests of the Pennsylvania Railroad Co. are represented by E. L. Goldsmith, supervisor of construction.

McKim, Mead & White are the designing architects of the post-office addition. Gibbs and Hill, of New York City, acted as consulting engineers to the architects on problems of design.

BEAM HANGERS (*below*) and nail-type spreaders hold girder soffit form in position for concrete fireproofing.



WEB FIREPROOFING on deep girders is built up of hollow tile to save weight.



ERECTING SHORT GIRDER which frames into 133-ton girder at left. Note temporary suspender in background in which long girder parallel with 133-ton member will rest until similar short girders can be erected at far end.

A. L. FELIO (*left*), general superintendent for James Stewart & Co., Inc.; E. F. O'BRIEN, construction engineer for supervising architect of Treasury Department; and GEORGE C. LANE, engineer of erection for McClintic-Marshall Corp.

Helps to Successful Contracting

Fifth of a series of articles on applying business principles to construction and making profits by avoiding costly mistakes

V—Selecting an Organization

By HARRY O. LOCHER

Contractor, New York

AN EXPRESSION often used by a famous contractor of an era which has gone, and which has had much to do with keeping his memory alive was, "Who is going to attend to it?" There was real meat in that query. Who attended to it is synonomous, in many cases with, "How did it turn out?"

Without doubt no other man on a contract job is of as vital importance as a highly capable superintendent. I do not mean the type of man who is just a rubber stamp for the contractor and whose outstanding qualification is that he is on the job every day. A real superintendent is a man with experience, knowledge of costs and a deep interest in them, alertness, judgment, snap, directness, disdain of carping criticism, strong convictions and the courage to express them. He is considerate and tactful in handling men, but demands results from them. He avoids all favoritism. He is thick-skinned, but always fair. He keeps posted as to new methods and equipment. He uses common sense and diplomacy in dealing with his superiors, principals and engineers. He selects his personnel and continues to study it, in order to eliminate all possible friction, and make it as cooperative, productive and as smooth-running as is possible. He tolerates no imposition upon himself or his company. With it all he is a fearless, loyal, honest man.

"There is no better policy than to let a really capable superintendent alone as much as it is possible to do so. He likes it and the contractor can spend more of his time on the other features of his business with which the superintendent has nothing to do."

Delegating Authority

Quite an order, you say, but there are such men. Some superintendents are of about as much use on a job as a dictaphone into which a contractor has poured his orders for the day. It might be well to say here that there are two types of contractors: One gives his work detailed attention and most of his time. Of course, such practice limits the amount of work he can do, and influences, too, the kind of an organization he has. The other type is the contractor who delegates authority easily and usually takes great pride in training men for the responsibility and authority which he later expects to give them. Nothing so gratifies a worthy man as to have confidence shown in him. And here is the place to say that nothing so dejects a man and kills his interest as evidence of lack of confidence in him. The second type of contractor builds up a more loyal following of really capable men, because they are strengthened with the confidence which they know the contractor has in them, and because most of the time they are on their own responsibility. The first type of contractor mentioned can use a type of man who lacks many of the qualifications that go to make a really bang-up superintendent. As a matter of fact, this type of contractor is actually his own superintendent, and his nominal superintendent, if he has one, is really little else than his messenger, with, of course, certain authority. There is no better policy than to let a really capable man alone as much as it is possible to do so. He likes it, and the contractor can spend more of his time on the other features of his business with which the superintendent has nothing to do.

A good superintendent keeps a close watch on costs. How can he possibly have the proper incentive for performing work in the most economical manner, unless he knows what it is costing? Some superintendents are given no idea as to costs and display no initiative, themselves, in discovering costs. They often work away in delightful ignorance at some particular job which is showing a tremendous loss. Sometimes this is the fault of the contractor who treats cost information as some deep, dark secret and never allows it to be available to the men who could make the best use of it. It would seem to be just ordinary good business to make men who are responsible for costs thoroughly familiar with most of the details that make them up. Foremen, too, should be made cost-conscious and shown that their crews of 20 or 25 men, at so much per day, are a substantial portion of the cost of the work. When it is driven home to the foreman that other additional costs almost equal his own, if he has any initiative, ingenuity or resourcefulness at all, they will come into play in an attempt to do work cheaper. We will get into this subject more fully in later articles.

It is well to allow superintendents to select their own foremen and mechanical men. They usually have a following of capable men who have worked together and get along well, and who know that so long as they deliver the goods these superintendents will stand up for them and treat them with consideration.

An outstanding man once said he could get a good deal done if he wasn't too particular about "who received the credit." There's a world of truth in what he said. It is highly important to give a man proper credit for anything out of the ordinary that he does. For someone else to claim credit at another man's expense is one sure way to kill interest, initiative and loyalty.

Some men seem to have an almost devilish desire to claim credit and receive acclaim for things conceived, planned and worked out by others. On contract work this is rank poison. A mechanic was asked why he didn't make a certain obviously needed repair on a dragline excavator which would have added considerably to its daily output. His reply was, "What's the use, old ———— gets credit for everything around here." He was referring to the man over him, who was an artist in claiming credit all along the line. Now, of course, this man's reply was not sensible, but it was human. Few men like to stand by and see good ideas they have suggested claimed by others. This unjust claiming of credit runs into money and is a killer of interest.

"A mechanic was asked why he didn't make a certain obviously needed repair on a dragline excavator which would have added considerably to its daily output. His reply was, 'What's the use, old——gets credit for everything around here.'"

Men like to know that confidence is felt in them. And they like to get credit when it is due them.

Leave It to George!

A big dragline excavator was to be loaded on a large scow at a rather hazardous location and for a rather risky river trip. The operator had done this sort of thing before, had full confidence in himself to do this job in a safe and creditable manner and was proud of his ability and skill in doing this particular stunt. The machine was moved to the river bank where the owner, the engineer in charge of the work and some of the other principals of the project were gathered. All agreed that it was a hazardous undertaking. There was a tide to consider, very bad

ground at the river's edge and uncertainty as to the strength of the scow to carry the load. There was a good deal of discussion all around. Finally, the owner called the operator into the group.

"Do you think you can make it, George?" he asked him.

"Sure, we've loaded 'em in worse places than this," he grinned.

Then the owner turned to the group and said, "You bet your life he can load it, and he'll land it just where you want it by noon tomorrow, eh George? Well, let's get away from here and give 'em a chance to do something."

"Some highly capable superintendents are not familiar with the details of machinery and its upkeep, and they should not interfere with the mechanic's work or go over his head, but should work through him and with him, using every care to retain his good will and cooperative spirit."

"Aren't you going to stay around and see them load it," the engineer asked.

"No, no, I have something else to do. There's the boy who will handle that job without a bobble," the owner concluded, jerking his finger toward the operator as he walked away.

George did handle the job. The machine was unloaded at the new location and ready for work by 9:30 the next morning. This operator and his crew appreciated the confidence that was shown in them, and they worked all night to justify it. Show confidence in good men. Nothing gratifies them so much.

There should be complete and smooth cooperation, too, between the superintendent and the man in charge of equipment and machinery. Oftentimes there is conflict here which is harmful. Some highly capable superintendents are not familiar with the details of machinery and its upkeep, and they should not interfere with the mechanic's work, or go over his head, but should work through him and with him, using every care to retain his good-will and cooperative spirit. Of course, too, all this applies as between the superintendent, his assistants, walking bosses and on through the organization. There simply must be harmony and cooperation on a contract job if the best results are to be obtained.

Harmony Essential

Two of America's widely known and exceptionally successful contractors constantly stress this point. They both define it as one of the most important things to keep in mind for successful contract work. Its accomplishment depends largely upon the superintendent. No milk-and-water type of man can round out and keep going a smooth-running organization. He must be a real man, with experience, courage and ability, coupled with the tact and diplomacy to create a smooth-running organization and really make 'em like it. A construction organization is something like a baseball or football team. Much more is accomplished by an organization of earnest cooperating men, under leadership in which there is both great confidence and respect, than by an organization in which there are a few non-cooperating, unity-destroying self-appointed stars.

A foreman was instructed by a superintendent one morning to do a certain thing. "You are the fourth man who has told me to do that, and you've all told me to do it in a different way," the foreman came back, with further pertinent trimmings to emphasize his opinion of the situation. What he said uncovered a non-cooperative situation on that job which was speedily corrected by the highly capable man in general charge.

On a particularly difficult and trying job which had gone through two changes of hands and a partial change of organization, with divided loyalties, a new night superintendent came in, replacing the former night superintendent who was to become his assistant. The veteran very much resented the newcomer and showed it in avoiding him, sulkiness and an almost complete non-cooperative spirit. His presence on the job was decidedly more of a detriment than a benefit.

The new man let the situation go along for three nights, meanwhile getting what information he could about the disgruntled man and sizing him up generally. From the new superintendent's personal observations and conclusions and from what he tactfully gathered from other sources, he decided that here was a good man "off on the wrong foot." So, on the fourth night at about two o'clock in the morning, he called him off to a remote spot and had it out, in a sensible, frank and direct manner. When the "battle" was over the two men shook hands, returned to their work as two splendidly cooperating construction men, the one remade, the other satisfied that he had done a good job in "man-making." This incident occurred twenty years ago, and the men are staunch friends today.

Too many situations of this sort are allowed to smolder. By the use of boldness, tact, consideration and the ability to point out, without arousing a feeling of resentment, the complete folly of such an attitude, competent men can nip such situations in the bud. Sometimes, this spirit of non-cooperation is well under cover, but an observing, capable, conscientious superintendent can soon discover and correct it. Sometimes, certain men have to be removed from the job—there is no working-together spirit in them. It is vital, too, that there should be cooperation between foremen, between machine operators, and between machine operators and foremen. All of this will be gone into in more detail in a forthcoming article on "Relatons With Employees." We are stressing here the great importance of a smooth-running organization and the fact that it is largely up to the superintendent, who knows a multitude of details bearing on this situation that never reach the contractor.

Relations with Engineer

It should go without saying that there should be wholehearted and friendly cooperation between the contractor's men and the engineers on the job. But it is a fact that such relationship is often far from what it should be. A great many thoughtless construction men seem to forget that engineers, too, are responsible to certain people and for certain things. It can be said with safety that practically all engineers would like to cooperate with contractors and members of their organizations and that they can be of most valuable aid to a contractor's work, quite apart from their strictly defined duties, if the proper feeling exists between them and the contractor and his organization. One assistant superintendent and the experienced engineer in charge didn't speak to each other for several months unless it was unavoidable. They deliberately avoided meeting. This was simply disastrous. The superintendent in this case was far from being the sort of man we have been trying to describe. This engineer too, might have been of an arbitrary type; but if deliberate effort had been made for conciliation, these two men would have got along, been friends, and the contractor would have been measurably better off.

"It is highly important to give a man proper credit for anything out of the ordinary that he does. For someone else to claim credit at another man's expense is one sure way to kill interest, initiative and loyalty."

Another engineer, recently out of school, and in charge of a concrete job, was the butt of much banter from the contractor's men on account of a slightly supercilious attitude and demeanor. In retaliation, he withheld from them all possible assistance in the correct placing of the reinforcing steel and chuckled when he saw them ripping out and resetting any steel which had been inaccurately set. This cost the contractor money. A change in the steel foremen happened to be made. The new foreman had served under the kind of superintendent we have called good. He quickly sized up this young engineer and they were soon as close as peas in a pod. There was no more banter from the steel crew. All sorts of assistance was given. The young fellow would even come out in the evening and assist the foreman to check steel and plan for the next day's work.

Now, to sum up: A smooth-running, dead-in-earnest organization is of vital importance to contract work. Such an organization depends largely upon the superintendent. He is in closer touch with the human relations and details than the contractor. Such a superintendent not only must have all the traits and qualifications we have enumerated, but also he must be able to spread his methods and influence effectively through his entire organization. A crack, all-around good superintendent is the gem of a contract job. With such a man in responsible charge a contractor can get some sleep at night and, if within the range of possibility, make money. The venerable contractor of long ago, who always wanted to know, "Who is to attend it," knew his stuff.

NEXT MONTH: The sixth article in this series by Mr. Locher, to appear next month, will be devoted to "Cost-Keeping and Records."

Forthcoming Articles

In addition to the five installments of Mr. Locher's series on "Helps to Successful Contracting" already published, it is planned to discuss the following topics in forthcoming articles:

- Cost-keeping and records
- Sub-contractors
- Progress schedules
- Relations with engineers
- Relations with employees
- Equipment
- Night work
- Cleaning up and moving to yard or new job
- General advice

Any Questions or Comment?

Construction men throughout the country have shown a keen interest in this series of articles. Certain points covered may suggest general comment or specific questions. Discussion by readers will be welcome and Mr. Locher will reply to queries of sufficiently general interest.

Address your comment or questions to the Editor of Construction Methods, 330 West 42nd St., New York City.

Step-by-Step Field Methods

Bridge Pier Caissons Lowered from Floating Gantry Trusses

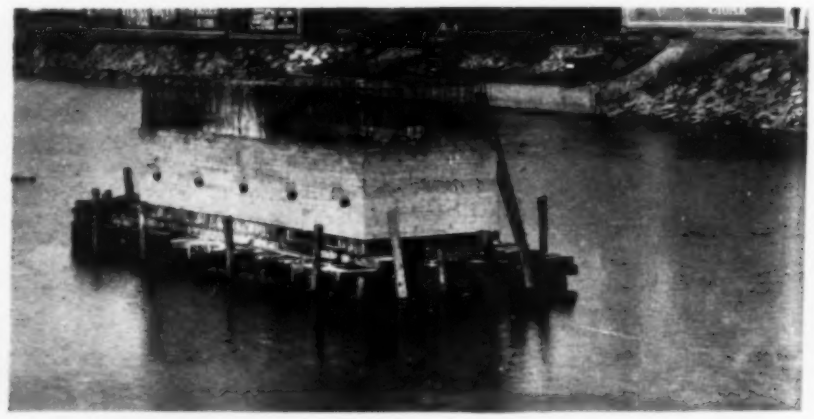
AN UNUSUAL method of positioning and sinking the caissons of three river piers featured substructure work on the Albany-Rensselaer highway bridge across the Hudson River, which the Booth & Flinn Co., of Pittsburgh, is building for the New York State Department of Public Works. The contractor avoided the difficulties involved in the usual procedure of launching and sinking by building up and lowering the caissons on threaded rods supported from floating gantry trusses. Construction of the bridge was described in general in CONSTRUCTION METHODS, December, 1932, pp. 12-16.

A pile-supported platform was constructed in the river and the cutting edge of each caisson was laid on this platform. After casting the bottom concrete lift of 8 or 9 ft. on the cutting edge, the contractor floated a set of parallel gantry trusses, supported at each end on a scow, over the platform and bolted the threaded rods by means of special connections, as illustrated, to steel lugs anchored in the concrete. Workmen then raised the cutting edge clear of the platform by taking up on ball-bearing jack nuts which supported the threaded rods on the top chords of the trusses.

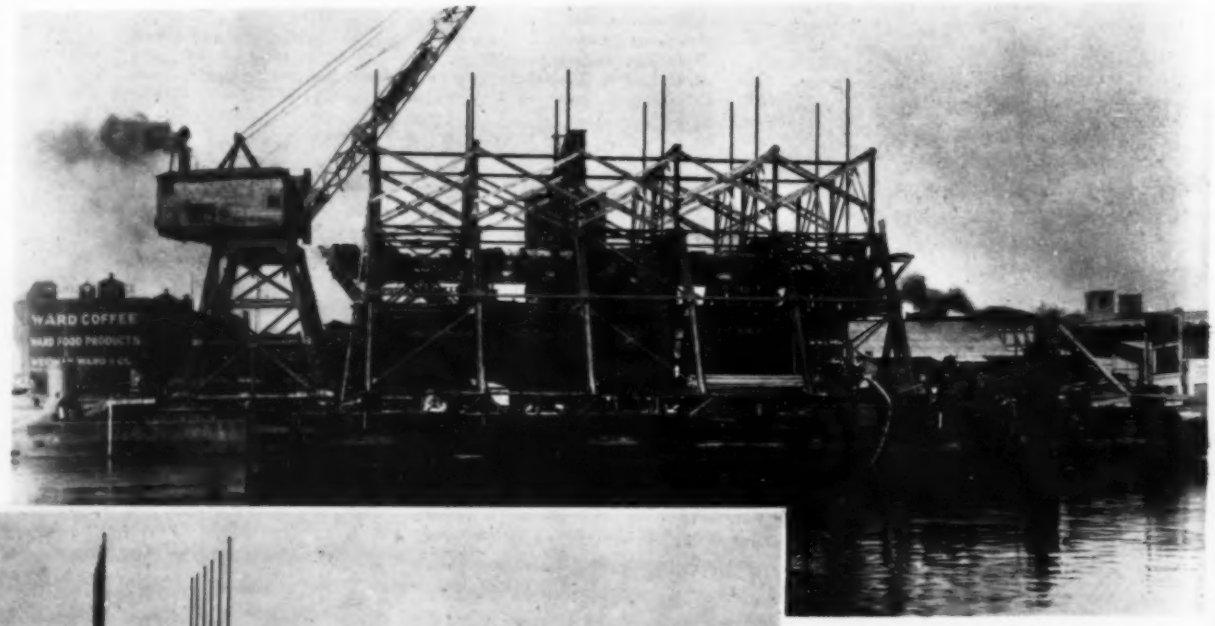
After moving the caisson clear of the platform, workmen lowered the cutting edge into the water to obtain partial flotation of the load. Tugs towed the scows and suspended bottom lift to proper position in the river, where the scows were anchored securely by lines in four directions.

Wood panel forms for the second lift of about 9 ft. then were erected

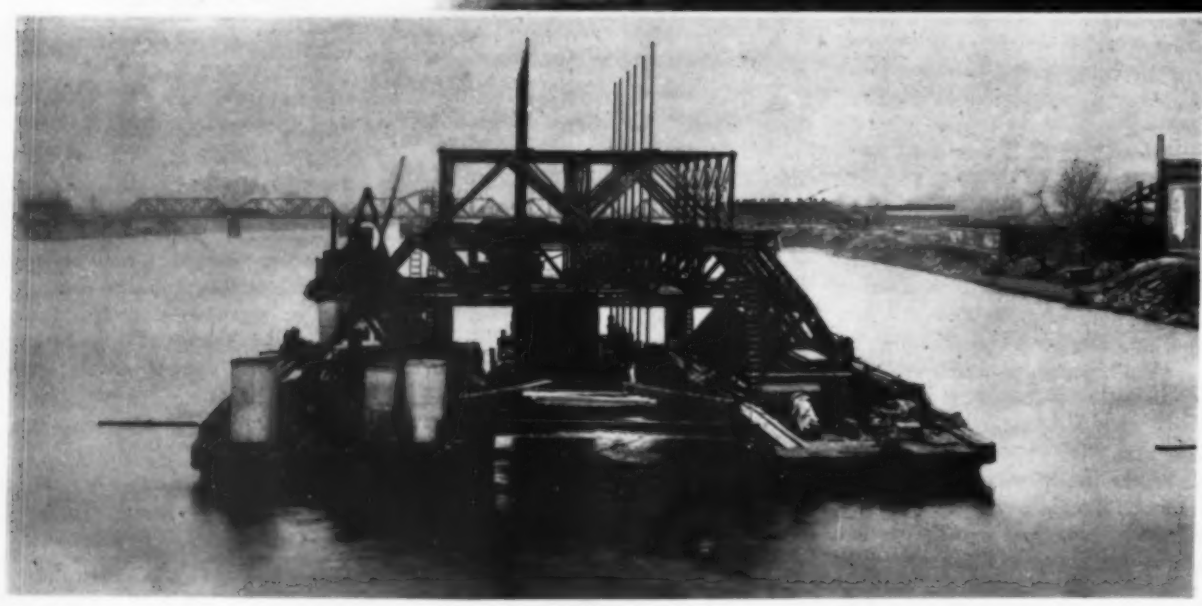
1 FIRST LIFT OF CONCRETE is cast in wood forms on cutting edge of caisson laid on pile-supported platform in river.



2 WITH FORMS STRIPPED, recesses are revealed in sides of caisson. Each recess contains a steel lug, cast in place, to which threaded rod will be attached.



3 GANTRY TRUSSES *(right)* are erected on pair of scows at Albany wharf. Each of six trusses carries two 4-in.-diameter threaded rods. Wood panel forms are ready for second lift of concrete.



4 AFTER FLOATING TRUSSES OVER PLATFORM, *(left)* workmen bolt lower ends of threaded rods to lugs in sides of first concrete lift. Rods on one side have been connected, and those to right are about to be attached.

5 SPECIAL SWIVEL CONNECTION *(left)* at lower end of threaded rod facilitates bolting to recessed lug in concrete wall. Note riveted spreader block which holds rod at proper distance from side of caisson.

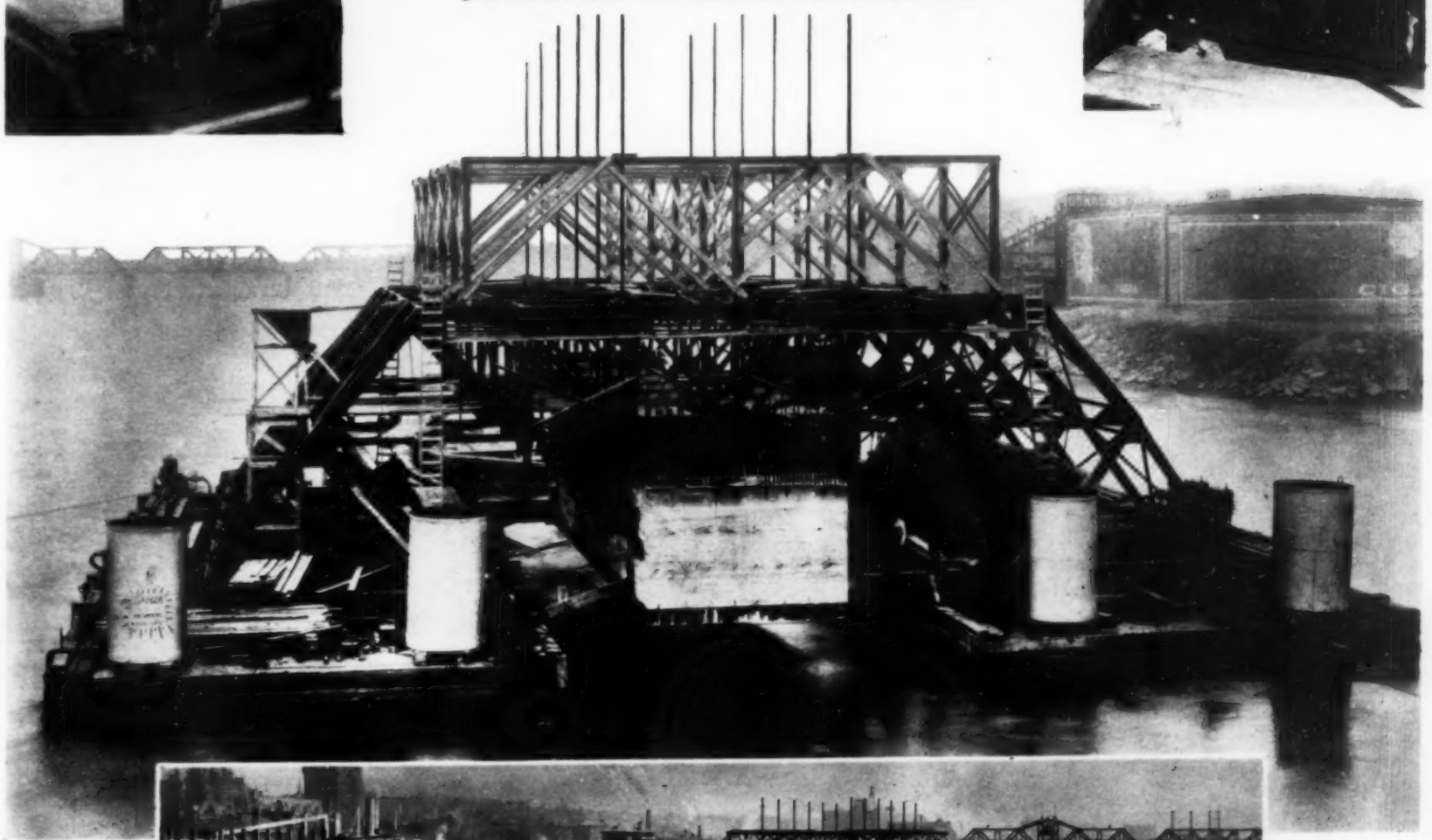
6 JACK NUT *(right)* on threaded rod supports rod on top chord of truss. Welded stubs afford grips for pipe handles used in turning nut when raising or lowering caisson.

and filled with concrete. As soon as the forms could be stripped, the caisson was lowered again to reduce the load on the threaded rods and make way for the construction of the third lift. Three lifts sufficed to bottom the caisson temporarily in the sand bed of the river, about 16 ft. below the water surface.

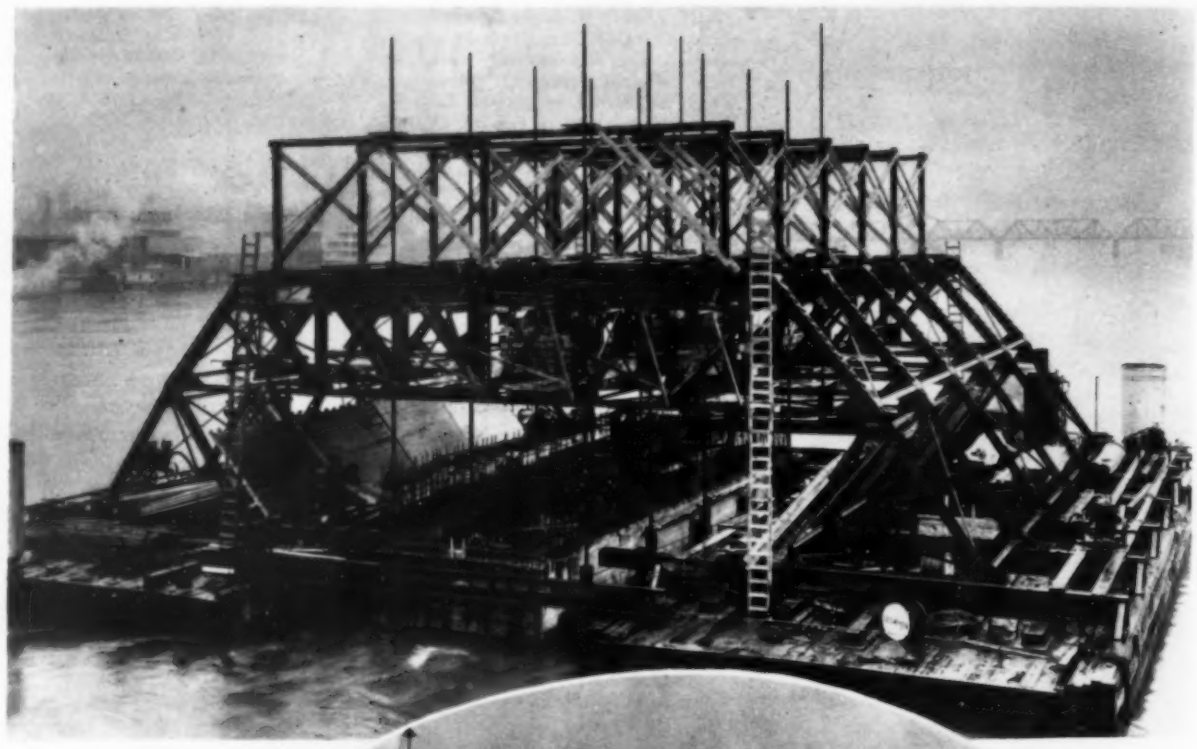
At this point, the threaded rods were disengaged and air locks were installed. Sinking proceeded by blowing sand until hardpan was reached, concrete lifts being added at the top, as before. Sand hogs then excavated hardpan and shale with pneumatic tools, sending up the spoil in buckets, until the caisson was bottomed permanently in shale bedrock. It never was necessary for the men to work at pressures greater than 18 lb. per square inch, and the maximum pressure used in a caisson at any time was 21 lb. per square inch.

Pier 1, the deepest caisson, was bottomed 86 ft. below mean high water level. This caisson was 26x79 ft. in area and had five working chambers. Pier 2 caisson was 22x79 ft. in outside dimensions, and Pier 3 caisson measured 16x67 ft. Pier 1 and Pier 2 support the towers of a

7 AFTER ATTACHING RODS AND RAISING CUTTING EDGE, *(below)* caisson is floated clear of platform. Scows are bulkheaded to give ballast control. White tanks on deck also are for ballast.



8 CAISSON FLOATED CLEAR of platform and partially submerged for moving to final position in river. Suction dredge at right is pumping sand for Rensselaer approach fill.



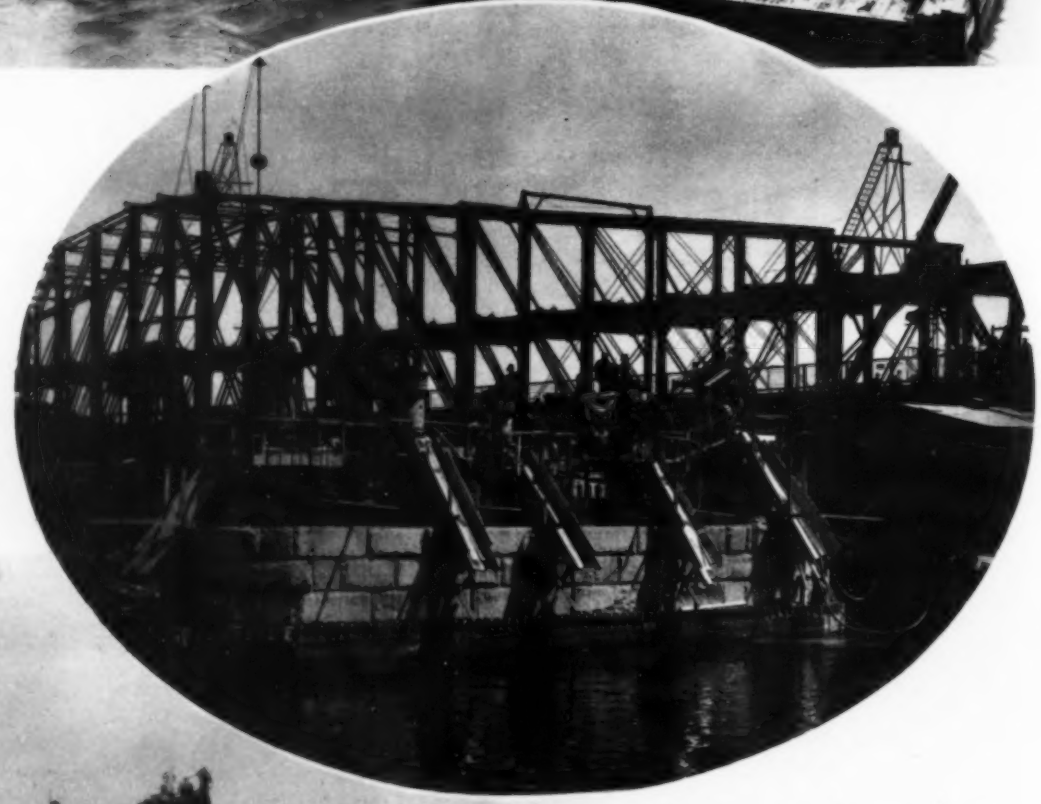
9 ANCHORED IN CORRECT POSITION *(right)* by lines in four directions, caisson is ready for erection of forms and construction of second concrete lift. Caisson is lowered after second lift, and again after third lift, until it is bottomed temporarily in sand bed of river. Air locks then are installed.

341-ft. lift span which has a clearance in raised position of 135 ft.

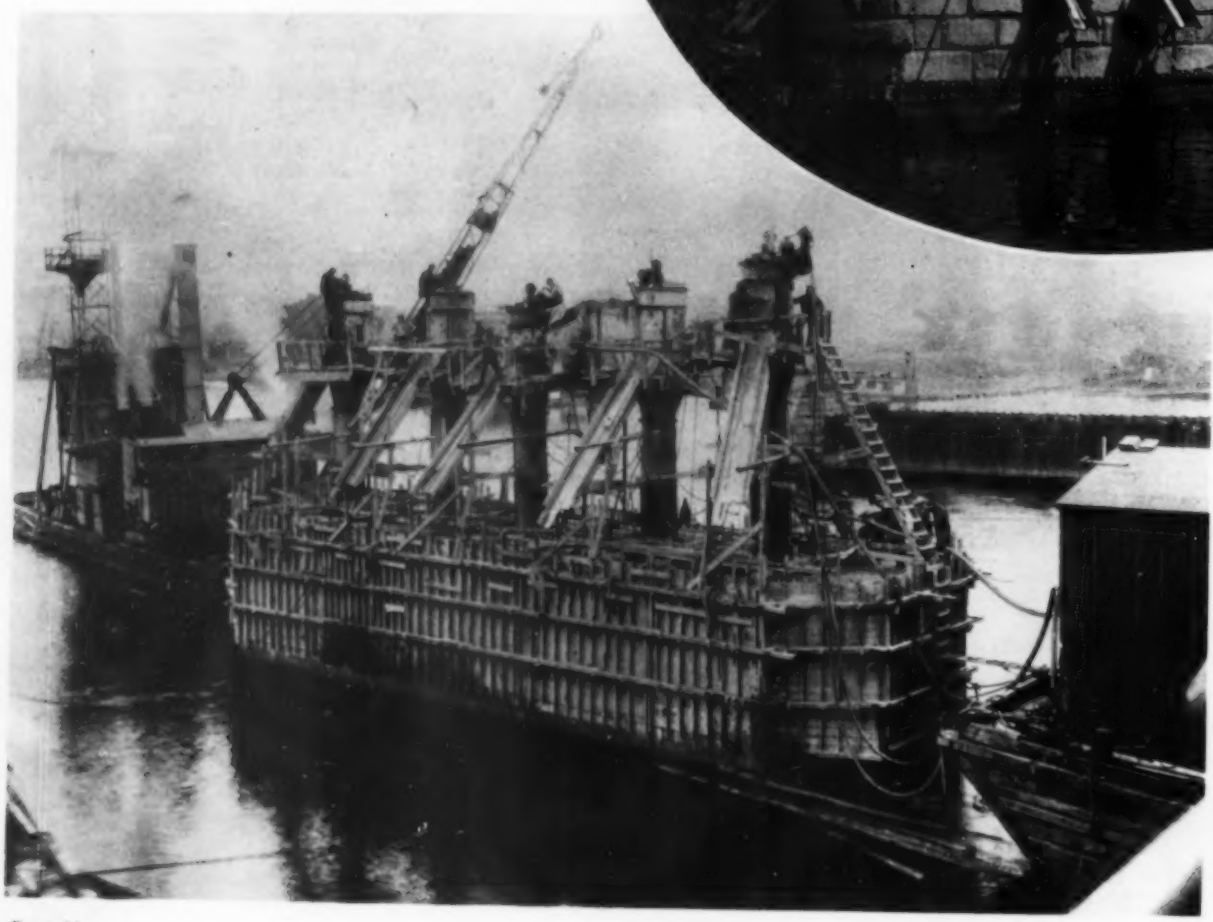
Each pier is faced with 14 ft. of stone extending 4 ft. below water level. On Pier 1, the last pier constructed, this stone was placed as the caisson settled. At the two other piers, the contractor used a different method, building a wood cofferdam on the caisson and placing the facing stone and concrete after the caisson had been bottomed in rock.

Six riveted trusses of 68-ft. span, pin-connected at each end to A-frames resting on heavy I-beams on the decks of the scows, supported the twelve 4-in. threaded rods used in lowering the caissons of the two larger piers. Only ten rods were required to handle the caisson of Pier 3. Tidal variations up to a maximum of 4 ft. existed at the site, but no great difficulty was experienced in holding the scows in position while lowering a caisson.

Caisson work was performed under the general direction of A. Rex Flinn, president of the Booth & Flinn Co. George Hockensmith, vice-president, and M. W. Murphy, superintendent, were in direct charge of operations.



10 FOLLOWING INSTALLATION OF AIR LOCKS, *(below)* sinking proceeds by blowing sand and excavating hardpan and rock until caisson is bottomed permanently in bedrock. Concrete lifts are added as caisson goes down.

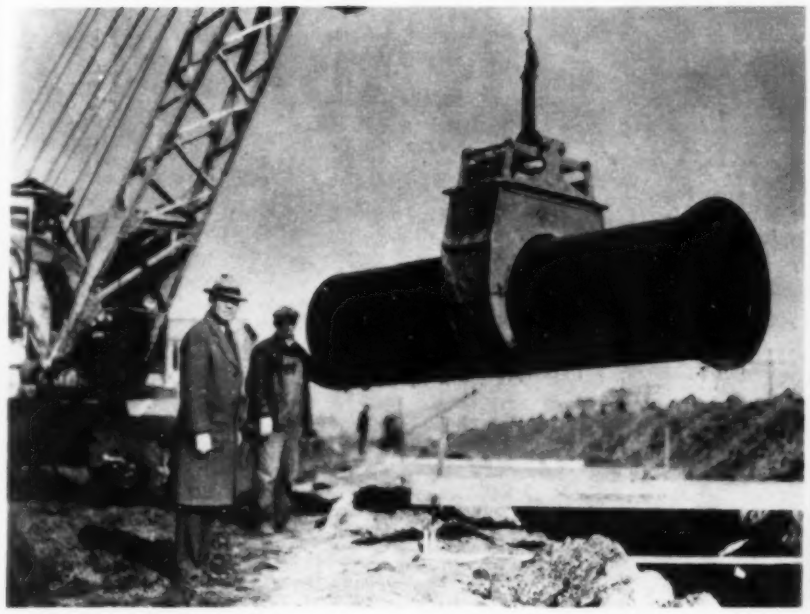


11 STONE FACING which extends from 4 ft. below to 10 ft. above mean water level tops out substructure of pier. Swing span of superseded Albany-Rensselaer highway bridge appears in background, and floating compressed-air plant to right of pier.

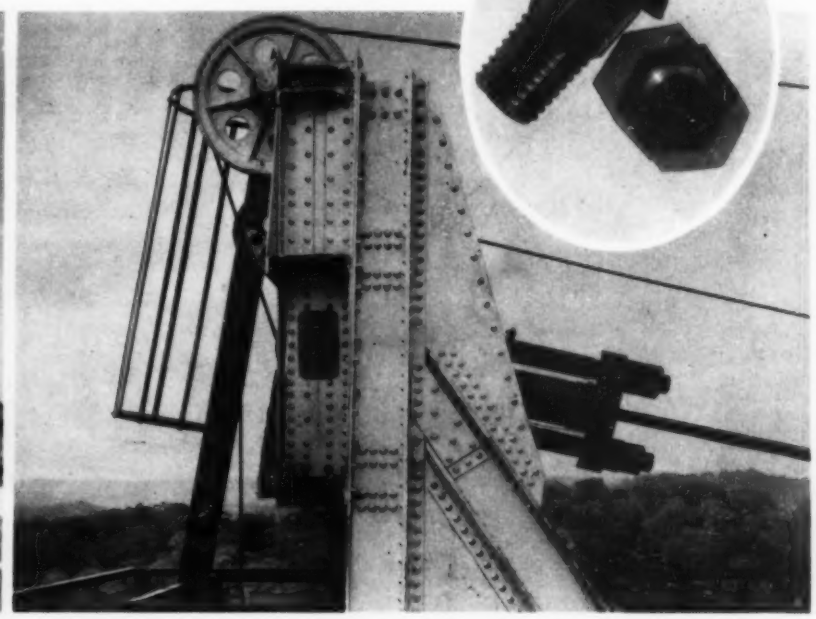
Frederick Stuart Greene is superintendent of the New York Department of Public Works, and Thomas F. Farrell is chief engineer. Design and construction of the bridge were supervised by H. O. Schermerhorn, assistant chief engineer, and field operations were directed by Oscar Hasbrouck, supervising construction engineer, and H. H. Brown, senior assistant engineer, who was resident representative on the project.

Getting Down to DETAILS

Close-up Shots of Job Methods and Equipment

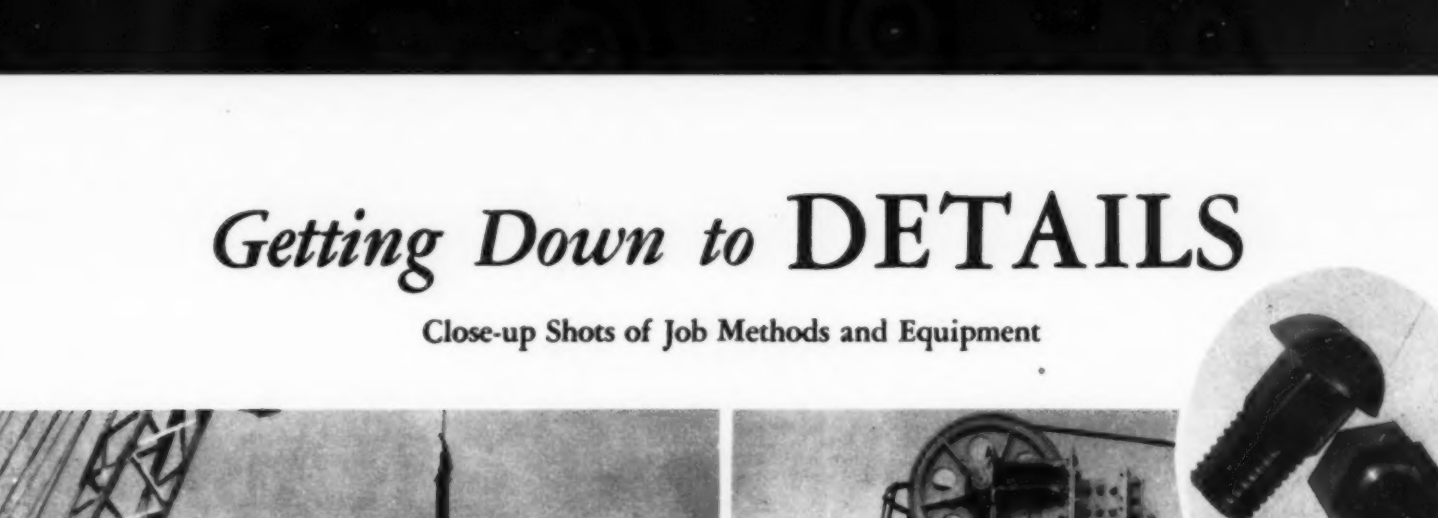


SPECIAL PIPE TONG handles sections of 36-in. cast-iron pipe in new 25-mi. line for water supply of Lincoln, Neb. Pipe of standard bell-and-spigot type was furnished in 12-ft. lengths by U. S. Pipe & Foundry Co. and installed under the general direction of D. L. Erickson, city engineer.

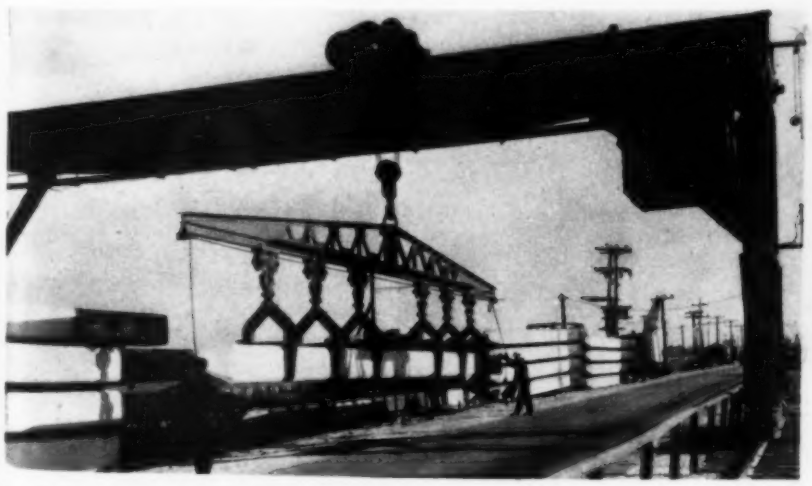


DEMOUNTABLE TOWER of structural steel supports cableway for Madden Dam in Canal Zone. Field connections are made with Dardelet "rivet bolts," so that when job is finished, structure may be knocked down and used at another site. Insert illustrates rivet bolt details.

TAKEN FOR A RIDE *(below)*. Ready-mixed concrete for platforms at new Cincinnati Union Terminal is delivered to job in trucks driven upon flat cars and hauled by locomotives to point of discharge. By this method 27,500 lin.ft. of platform was poured, varying in width from 4½ to 8½ ft. and 6 in. in depth.



GRAPPLE TRUSS *(below)* on gantry crane is equipped with six hangers carrying tongs that are fitted around precast concrete piles, gripping them from underneath. Piles, in lengths from 40 to 68 ft., were used for bridge construction at Great Egg Harbor, N. J., by Eastern Engineering Co., under the direction of New Jersey State Highway Department.



ELECTRIC VIBRATORS consolidate dry, no-slump concrete mix for Pasadena Water Department's Pine Canyon Dam, in California. Concrete is delivered in 4-yd. buckets by two 1,000-ft. cableways. Dam will be 245 ft. high, containing 436,000 cu.yd. of concrete. Contractors, Bent Bros., Winston Bros., and W. D. Crowell.

Madden Dam Aggregate Handled by

MILE-LONG AERIAL TRAMWAY

By A. J. ACKERMAN

Chief Engineer,

W. E. Callahan Construction Co., & Peterson, Shirley & Gunther, Contractors

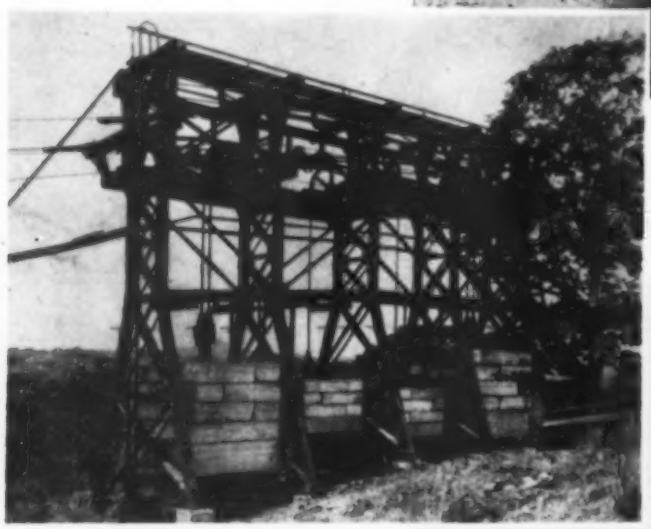
ONE of the features of the construction plant serving the Madden dam, being built across the Chagres River to augment the supply of water for lockages at the Panama Canal, is a mile-long aerial tramway capable of delivering 225 tons of gravel per hour to the screening plant which supplies aggregate to the concrete mixers. The main section of the dam is a concrete structure 900 ft. long and 220 ft. in maximum height, flanked by an extension in the form of an earth and rock embankment, with concrete paving on the upstream face. In addition, there are thirteen smaller saddle dams of earth and rock fill. The Madden dam project was awarded at a total contract cost of $4,048,657. Its location, although only about 10 mi. from the canal, is a tropical jungle.

While the Chagres Valley contains an almost continuous gravel deposit, it was necessary to open a pit about 1 mi. downstream from the dam site, in a flatter country, where an abundant supply of proper gradation was available, particularly with respect to sufficient fines. About 600,000 cu.yd. of gravel will be transported over this tramway.

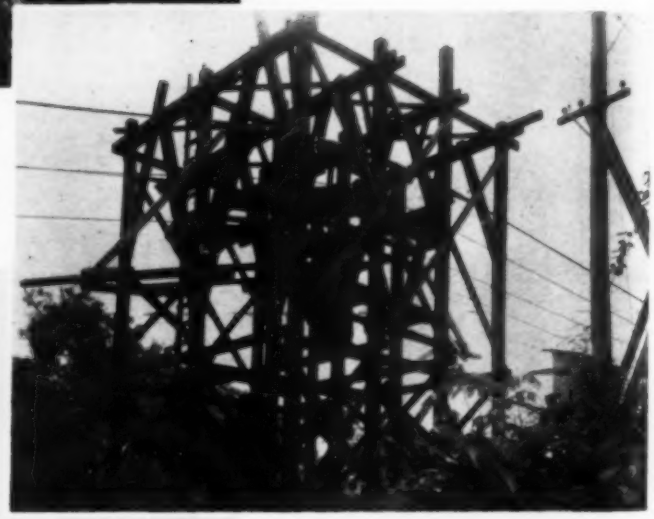
The gravel is loaded from its bed by a Bucyrus-Monighan 2½-yd. walking dragline into 5 cu.yd. side-dump cars operating on a narrow-gage track. These cars dump at the tramway loading terminal through 9-in. grizzlys into two hoppers set below ground level. A 36-in. belt conveyor, about 200 ft. long, discharges at the top of a 360-cu.yd. tramway loading bin. As an auxiliary means for loading this bin, its top has been covered with grizzly bars and a 2-cu.yd. Sauerman slackline cableway excavating unit erected to reach about 100,000 cu.yd. of gravel in front of the bin and load directly into it.

On the tramway side of the bin two air-operated gates feed the gravel into buckets of 32-cu.ft. capacity at the rate of two per minute. The buckets are automatically spaced and dispatched out on to the line, grips taking hold of the endless traction rope as the buckets leave the terminal. The buckets entering the terminal are in a similar way auto-

AERIAL TRAMWAY, crossing Chagres River, is one mile long and delivers 225 tons of gravel per hour to the screening plant.



DOUBLE TENSION TOWER supports four dead ends of cables and their counterweights. It is built of structural steel; other towers are of wood.



HEAVY TIMBER STRUCTURE, with suitable mechanical features, carries span over a sharp peak in the tramway line.

DISCHARGE TERMINAL of aerial tramway above screening plant.

matically released from the traction line and come to rest at the loading spouts. Normally, four buckets are in the terminal at all times and 50 on the line. The conveying speed is 500 ft. per minute and the buckets are spaced on the line at 250-ft. intervals. A 100-hp. motor is required to keep the 2-mi. circuit of loaded and empty buckets in motion.

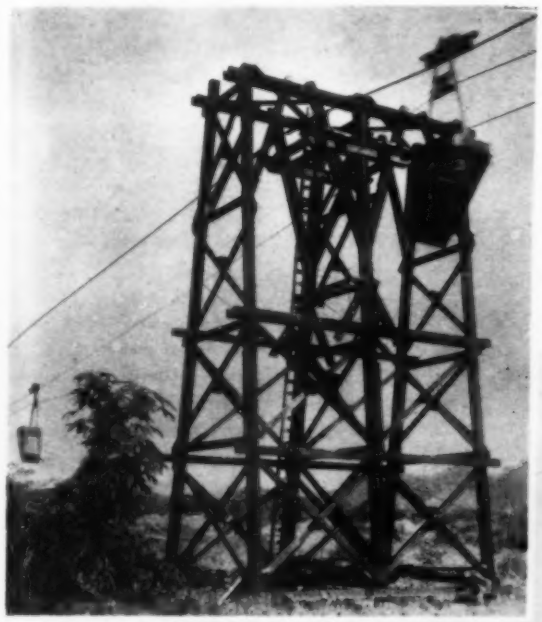
The discharge end of the tramway is located at the main plant area adjacent to the dam site. The terminal was mounted directly on top of the screening plant to provide a gravity flow to the screens. Opening, dumping and reclosing of buckets is entirely automatic without stopping them, and their return travel is accomplished by passing them around a 16-ft. diameter sheave. The receiving hopper is 24 ft. long and has a capacity of 30 bucket loads.

The track cables are of locked coil construction, the main cable being 1¾ in. in diameter and the return line 1 in. in diameter. The line, as illustrated in the accompanying diagram, crosses the Chagres River twice; its longest span is 1,826 ft. and the shortest 400 ft.

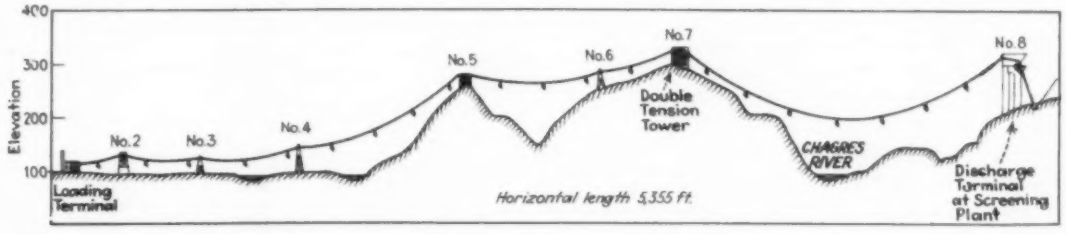
There are four different types of towers in the tramway. The five lightly loaded ones are of timber, while the double tension tower, which supports four dead ends of cable and their counterweights, is built of structural steel. Tower No. 5 is a heavy structure with suitable mechanical features for carrying the span over a sharp peak. The track cable is supported in the various towers on a rocking type of shoe.

Personnel—The Madden dam project was designed by the Bureau of Reclamation for the Panama Canal and is being constructed under the supervision of the Canal Zone administration, including Julian L. Schley, governor; Col. C. S. Ridley, engineer of maintenance, and Major J. C. Mehaffey, assistant engineer of maintenance. E. S. Randolph, construction engineer, is in direct charge of the work, I. E. Burks is chief concrete technician, and A. W. Brooks, engineer on dam.

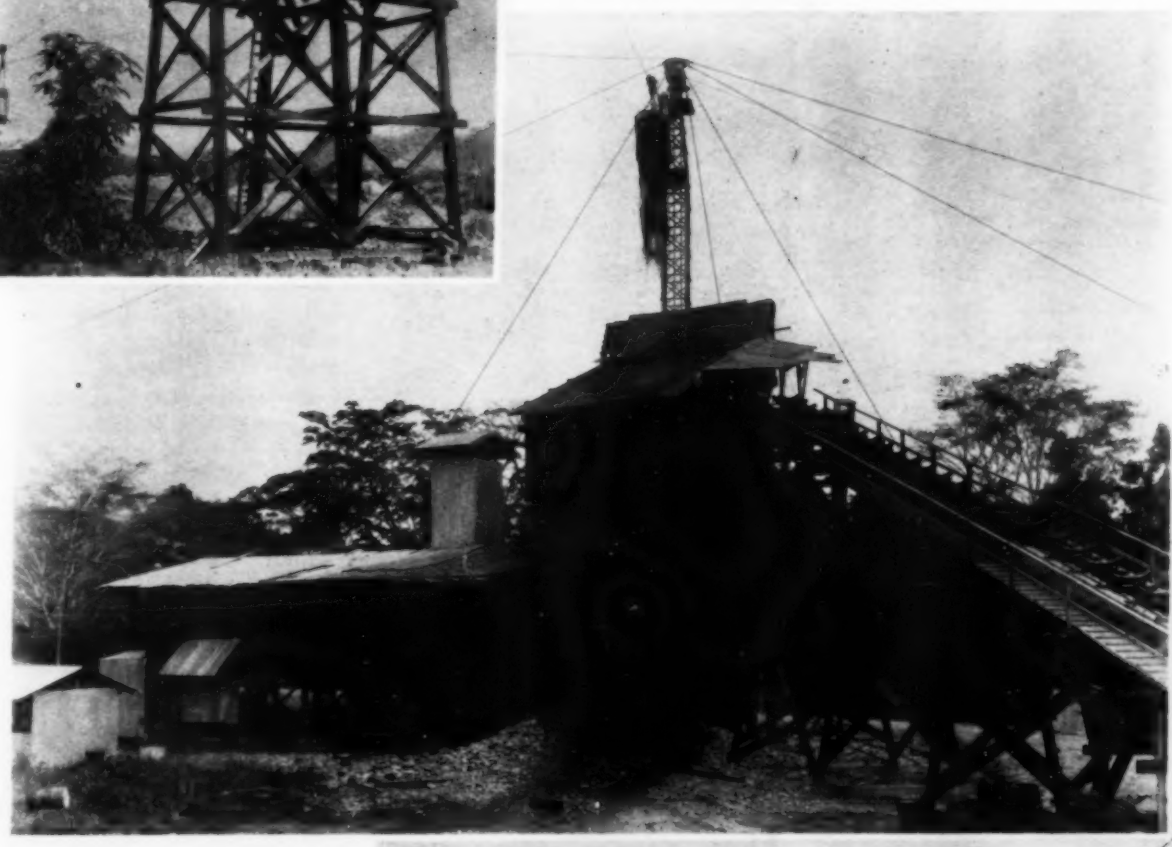
For the contractors, Paul Grafe is managing director and R. M. Conner, general superintendent. The aerial tramway was designed and all cables and machinery fabricated by the American Steel & Wire Co. and erected under their supervision, with George Hall as resident engineer. The steel double tension tower was fabricated by the Virginia Bridge & Iron Co., Birmingham, Ala. The screening plant was designed and fabricated by Stupp Bros. Bridge & Iron Co., St. Louis, Mo.



TRACK CABLES *(left)* **are supported in wood frame towers by rocking type of shoe.**



PROFILE of tramway, showing terminals and location of towers.



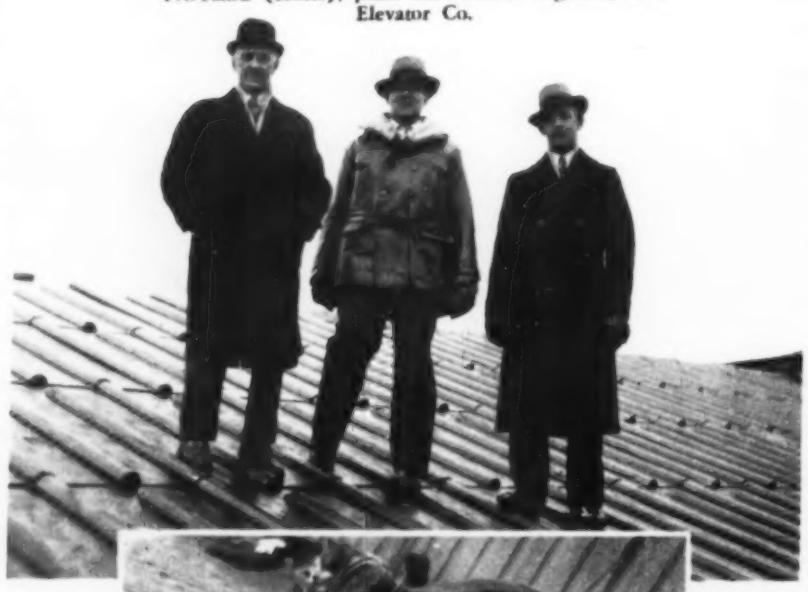
BUCKETS *(below)* **of 32 cu.ft. capacity, spaced at intervals of 250 ft. on cables, travel at speed of 500 ft. per minute.**

LOADING TERMINAL is fed with gravel by slack-line cableway bucket and conveyor.

Thin Cast-Iron Plates Form Durable

FACTORY ROOF

EDWARD L. PARVIN (left), sales engineer, and EDWARD HERING (right), assistant chief engineer, United States Pipe & Foundry Co. WILLIAM G. NUTZEL (center), plant maintenance engineer, Otis Elevator Co.



PERMANENCE, practical elimination of maintenance expense and ease of erection are the principal advantages of a new cast-iron plate roof developed by the United States Pipe & Foundry Co. and applied for the first time outside the mills of the manufacturer to a section of saw-tooth roof on an assembly shop of the Otis Elevator Co. plant at Harrison, N. J. A long period of experiment in design and methods of manufacture preceded the introduction of the cast-iron plate roof.

Features of Roof—The roof is made up of thin cast-iron plates laid on and securely attached to the channel purlins. Although the plates can be cast in any length to fit the requirements of a particular roof, the standard dimensions, employed in the replacement work at the Otis Elevator plant, are 4 ft. 4 in. long by 2 ft. wide. The plates are only $\frac{3}{16}$ in. thick, and are correspondingly light in weight, the 24x52-in. plates weighing 78 lb. Tests indicate that one of these plates can carry a total uniformly distributed load of 4,000 lb. on a 4-ft. span with an average deflection of $\frac{3}{8}$ in. at the center of the span.

Cast iron in plate form retains all the indestructible qualities that have made its use advantageous in underground water pipes and certain types of superstructures. The cast-iron plate roof is practically fireproof and is securely attached to the purlins by a simple device which prevents the plates from being lifted by the wind.

Simplicity in the design of the component parts of the roof contributes to speed in erection. The flat plates forming the basis of the roof have 1-in. upward projecting flanges along the two sides and two downward projecting lips, or stops, at the upper edge which catch on the roof purlin and prevent the plates from sliding downward. Extending longitudinally through the center of the plates from the lower edge to a point about 6 in. below the upper edge is a semi-cylindrical ridge of $3\frac{1}{2}$-in. inside diameter. This semi-circular ridge in the plate strengthens the casting and also serves as a hood to fit over the semi-circular cap plate of the next lower course on the roof.

Semi-circular cap plates to cover the longitudinal joints between flat plates are cast with lugs normal to the inner circumference. A space of about 1 in. is left between the flanges of adjacent flat plates at the joint. When the cap plate is placed over this open joint, the lug, extending downward through the opening, rests against the upper flange of the roof

RIBBON OF CALKING COMPOUND *(right)* between lapped plates forms weathertight joint.

ERECTION OF CAST-IRON PLATES is performed entirely by two men working on roof. Movable A-frame is used in hoisting plates from inside building.

STANDARD FLAT PLATE rests on roof purlin at upper end and laps 4 in. over plates of lower course. Man at right holds semi-cylindrical cap plate to cover joint between flat plates.

purlin. The lug has a slot, or keyway, through which a key is driven, as illustrated by the accompanying perspective sketch, to lock the cap plate to the upper flange of the channel purlin. Cap plates are the same length as the flat plates and are closed at the lower end.

These three items, the standard plate, the cap plate and the key, make up the entire list of materials needed for a roof slope. The only additional parts required for an ordinary roof job are the specially shaped ridge plates and ridge cap plates. Certain roof jobs require special trim plates, in addition.

Erection Procedure—Cast-iron plate roofs are erected by courses, starting with the bottom course of the slope. As soon as two plates have been laid, leaving about 1-in. spacing at the joint, the cap plate is placed over the opening, and a workman drives the key which locks the unit to the roof purlin. These operations are repeated until the bottom course has been carried as far as desired, when erection of the second course is started.

Joints of the second course are staggered midway between the joints of the first course, the hoods of the upper plates fitting over the cap plates of the lower course. The plates lap 4 in. All erection operations are performed by workmen on top of the roof. It never is necessary to have men work on scaffolding underneath.

On a pitched roof of ordinary type, the ridge plate and ridge cap plate would be fastened to the purlins by keys in the same way as the standard plates. Ridge plates on the sawtooth roof of the Otis Elevator plant, however, were of a somewhat different design, as illustrated by one of the accompanying photographs, and were fastened securely to the sash angle by bolts.

Progress—A roof area 130 ft. long by 25 ft. on the slope was covered with cast-iron plates at the Harrison, N. J., plant. Two men removed the old roof and erected the cast-iron plates. The actual time required for erection of cast-iron plates on the day when a representative of CONSTRUCTION METHODS visited the job was 4½ hr. for 150 plates, or about 1.4 squares of roofing per man-hour.

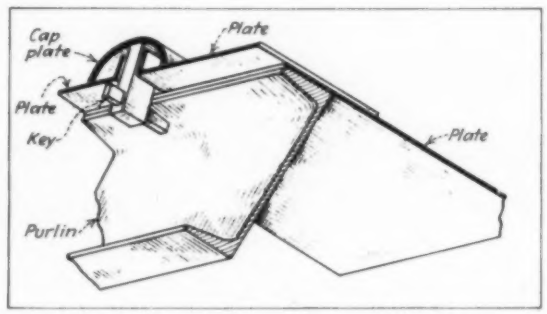
Paint and Cement—Although paint is not necessary to protect the cast-iron plates, it is possible to color the surface as desired. At Harrison, the plates were painted red on the upper surface to correspond with the rest of the roof and were coated with aluminum paint on the under side to reflect light.

Where the plates lap, a strip of plastic cement was placed between the plates to form a weathertight joint. Although this joint calking is not essential, it is expected that it will be specified by many engineers on industrial jobs.

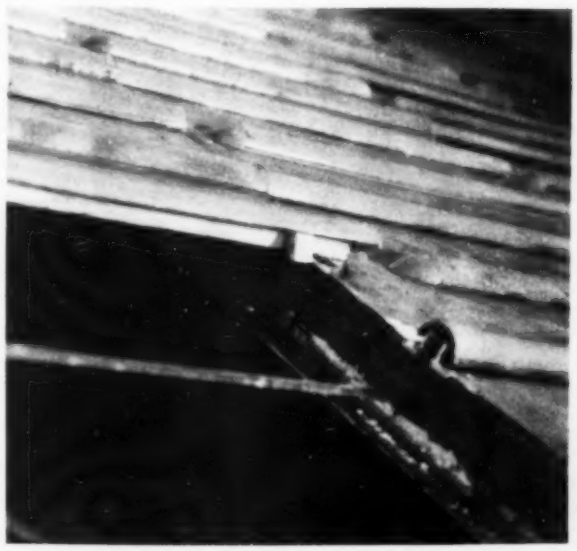
Manufacture of Plates—A great deal of study and experiment went into the development of the cast-iron plates, particularly in regard to such items as shape, dimensions, method of attaching to roof purlins, weight and strength. No problem presented greater difficulty than the method of casting the standard flat plate. Permanent iron patterns are used in casting these plates at the Burlington, N. J., plant of the United States Pipe & Foundry Co. The plates are cast in flat position, with the flanges and semi-cylindrical hood turned down. Two hot metal runs are used, one at each side of the plate, with thin gates into the mold.

Keys—Keys used to lock the cap plates to the roof purlins at the Otis Elevator Co. job were of mild steel and were 3 in. long by ½ in. high by $\frac{3}{16}$ in. thick. The keys were processed by the Philadelphia Rust Proof Co. to protect them against corrosion.

Direction—Edward Hering, assistant chief engineer of the United States Pipe & Foundry Co., who has been largely responsible for the development of the cast-iron roof, supervised the work for his company at Harrison, N. J. Chamberlain & Patterson, of Newark, N. J., erected the roof for the Otis Elevator Co. under the direction of William G. Nutzel, maintenance engineer of the plant.



KEY inserted through slot in lug of cap plate and lightly tapped with hammer locks plate roof to purlin. ERECTOR *(below)* has inserted key in slot temporarily to indicate method of making this connection.

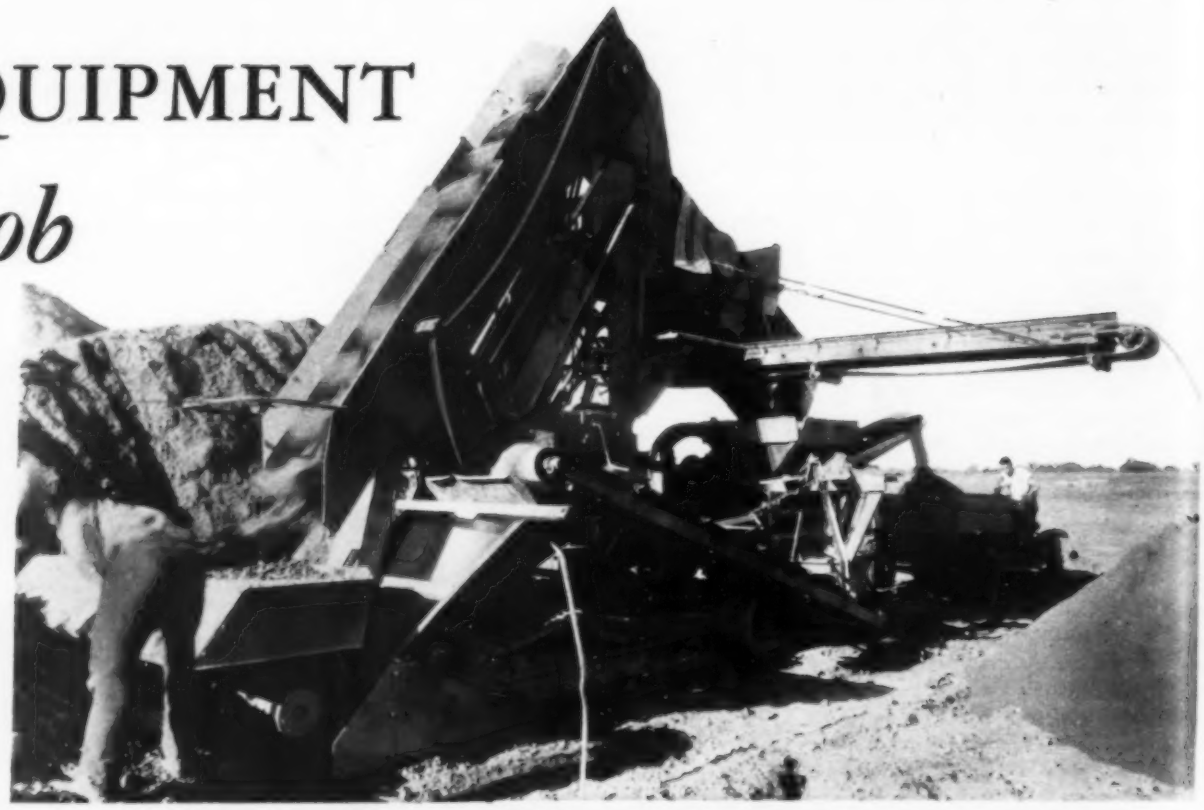


CAP PLATE is held in temporary position to demonstrate purpose of lug and keyway. In actual erection, cap plate is placed over flanges of two flat plates, as at right.

SPECIAL RIDGE PLATES for this job have lapping flanges which eliminate need for ridge cap plates. Ridge plates are bolted at lower edge to sash angle.

THREE PARTS of cast-iron roof: flat plate, cap plate and ridge plate. Semi-cylindrical longitudinal ridge in flat plate strengthens unit and laps over cap plate of next lower course on roof.

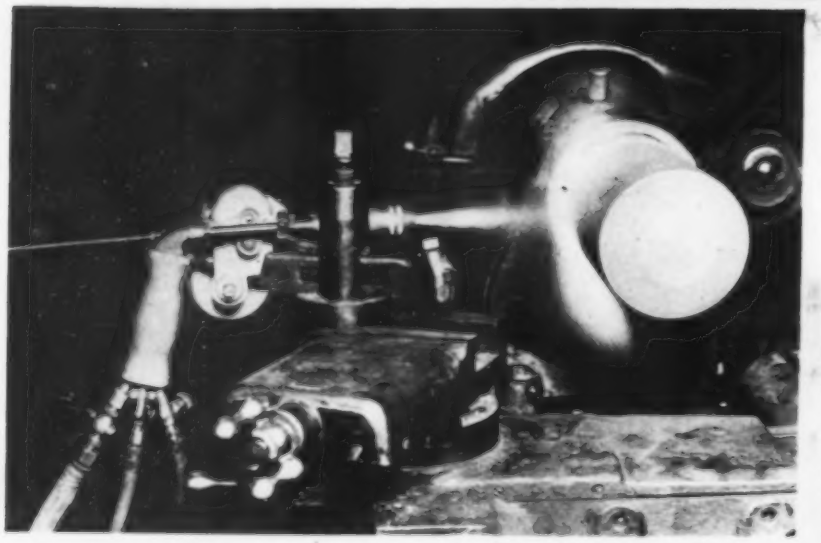
New Equipment
On the Job



CRUSHING PLANT *(right)*, designed for use in conjunction with B-G bucket loader with vibrating screen, forms complete excavating, screening, crushing and loading plant, self-propelled and portable. Loader has own gasoline engine which drives crawlers, buckets and screen. Crushing plant, towed behind loader, is equipped with engine for driving crusher and conveyors. Plant works directly into bank or stockpile, the entire machine moving forward as material is excavated. Only one operator is required. Under normal conditions plant handles 40 to 50 cu.yd. per hour.—Barber-Greene Co., Aurora, Ill.

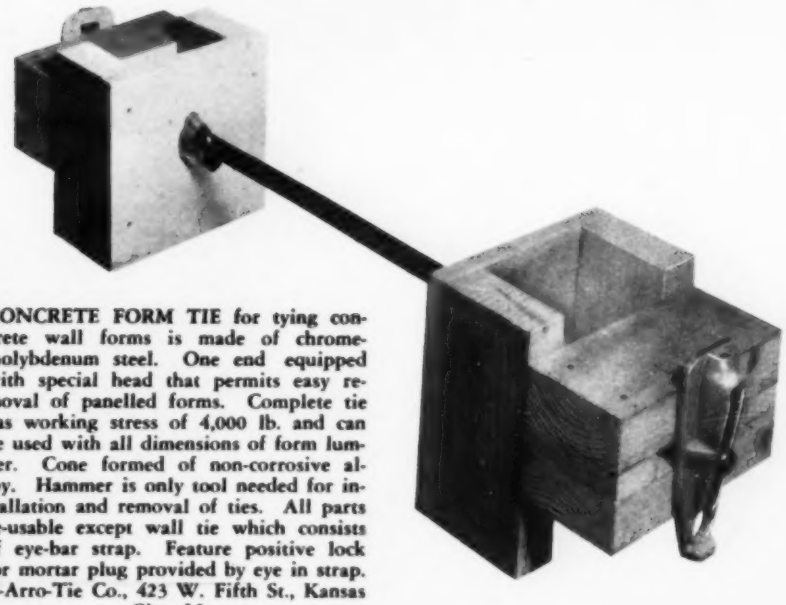
12-YD. BOTTOM-DUMP WAGON *(left)*, designed for use with larger tractors, is built with straight wagon body sides, permitting easier and quicker dumping in all kinds of soil. Extra wide doors and high clearance permit wagon to be dumped quickly and easily and hauled off windrow with little increase in draft. As doors drop, draft lightens, making shifting of gears unnecessary while on dump. Wide flange at top of wagon provides for large top loads.—La Plant-Choate Manufacturing Co., Cedar Rapids, Ia.

DUAL DRUM PAVER equipped with two standard drums joined by discharge chute which conveys material from one to the other. All operations are synchronized by automatic control. Batch is mixed half specified time in first drum and other half in second. Mixing action is continuous both in drums and during transfer. Overall dimensions are same as standard 27-E except as to length. Crawlers are longer, but unit subgrade pressure is less. On same job dual drum with batch meter set for 1¼ min. mixing time and with crew of 3 additional men placed 724 cu.yd. against standard machine's 478 cu.yd.—Ransome Concrete Machinery Co., Dunellen, N. J.



METAL SPRAYING GUN employs process of spraying molten metals on all materials. A compact hand tool consisting of air turbine supplying power through reduction gears to two knurled wheels that feed metal wires into an oxy-acetylene flame. As flame melts wire, air blast atomizes and impacts metal against any desired surface. Gun can spray any metal obtainable in wire form. All surfaces to be coated are first sand-blasted to make them chemically clean. Any desired thickness of coating. Made in 3 sizes for wire of 12 gage (0.08 in.); ¼ in. and ⅛ in.—Metal Spray Co., 113 Llewellyn St., Los Angeles, Calif.

TRACK-TYPE TRACTOR for working at high speed in loose or wet soil and in close quarters. Develops maximum of approximately 28 drawbar hp., has four speeds forward of 2.23 to 5.8 m.p.h. and one reverse speed reaching 2¼ m.p.h. Weight 6,200 lb. Track shoes, 12 in. wide. Overall length, 101¼ in.; overall width, 57¼ in. Height to top of radiator, 56⅞ in.—Allis-Chalmers Mfg. Co. Milwaukee, Wis.



CONCRETE FORM TIE for tying concrete wall forms is made of chrome-molybdenum steel. One end equipped with special head that permits easy removal of panelled forms. Complete tie has working stress of 4,000 lb. and can be used with all dimensions of form lumber. Cone formed of non-corrosive alloy. Hammer is only tool needed for installation and removal of ties. All parts re-usable except wall tie which consists of eye-bar strap. Feature positive lock for mortar plug provided by eye in strap. —Arro-Tie Co., 423 W. Fifth St., Kansas City, Mo.

INTERCONNECTED METAL TRENCH AND EXCAVATION GUARDS of rustproof, malleable iron used with ordinary 2x6-in. planks as guard rails, form complete fence around excavations or trenches regardless of contours. Patented, swiveling construction eliminates space between barricades and cuts in half number of supports or horses required on job. Combination lantern and flag support. Easily dismantled and set up.—Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland, Ohio.

NEW TYPE OF GUARD RAIL consisting of two rows of "Traffic Tape" attached by offset fittings to line posts. Tape consists of same size wires as standard ¼-in. cable woven into flat band *(insert)* 2½ in. wide and held in place by half-round clips threaded through them at 6 in. intervals. Advantages claimed: increased tensile strength; greater visibility; does not constitute snow removal barrier. Shipment made on wooden reels carrying 2,500 ft. Weight approximately 87 lb. per 100 linear feet.—Page Steel & Wire Co., Bridgeport, Conn.

BOTTOM-DUMP CRAWLER wagon for use with high-powered, high-speed tractors has full 10-yd. struck measure and 13-yd. heaped measure capacities. Equipped with 20-ton crawler wheels. Straight tubular tongue gives direct line draft without interfering with short turning. Other features reversible flare-board; low loading height; doors extra wide and long.—The Trackson Co., Milwaukee, Wis.

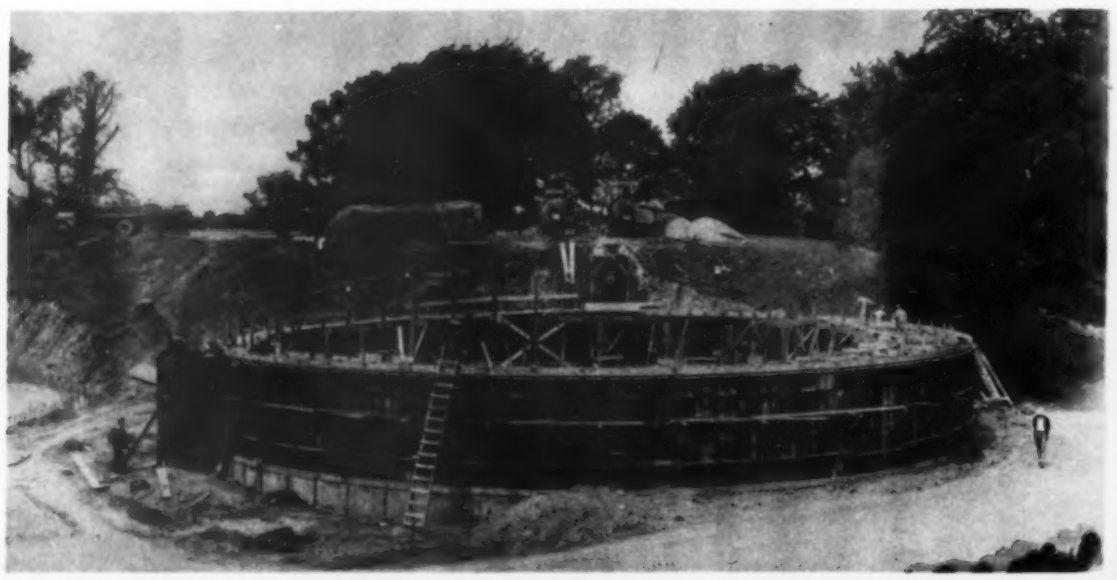
If You Want Further Information—

Within the space limits of this page it is impossible to present complete information about the products illustrated.

The manufacturers, however, will be glad to supply further details if you will write to them.

We Mean....

SAVE WITH Metaforms



Build a form for a 40' reservoir with Metaforms

then assemble the same units for a rectangular tank

If you work with Concrete write for the latest Metaforms Bulletins

METAL FORMS CORPORATION

Milwaukee, Wis.

Since writing this letter, Peterson & Simmons have ordered a K-48 Shovel, making their eighth Link-Belt machine.

S. J. PETERSON
PHONE 47

T. G. SIMMONS
PHONE 139

PETERSON & SIMMONS

DRAINAGE CONTRACTORS

FAIRFAX, MO.

October 26, 1932

DRAINAGE DITCHES
SOIL-SAVING DAMS

Mr. (Name on Request)
St. Louis, Missouri.

Dear Sir:

We have been using Link-Belt Crawler Cranes as Draglines for six years, with very good service. The first machine we ever bought, a K-42, is still in service. We have consistently made a habit of what the manufacturer would call overloading the machine. On a K-30 or one yard machine, we always use an Omaha, yard and a quarter bucket, and on a K-44, which is supposed to be a yard and a half machine with a forty-five foot boom, we are at the present time using a yard and three quarter Omaha bucket with a fifty-five foot boom with one machine, and a sixty foot boom on the other machine. These machines handle these very nicely.

For the first year and a half, or two years, double-shifting a Link-Belt, there is very little expense for repairs. This would be equal to four years' life of single shifting. We took two Link-Belt K-44's and dug a million yards of dirt in five and a half months, with the help of a K-30 for about two months of the time. The job varied from wet gumbo to very good digging.

Link-Belt machines are under-rated as compared to other machines, for there are two or three machines on the market that make a yard machine and power it with a six by seven Waukesha Motor. Link-Belt powers theirs with a six and a half by seven Waukesha Motor and still calls it a yard machine.

One of the best things about Link-Belt Company is that they are an honorable, straightforward group of men to do business with. They are cautious of what they say, but when they say it, they stay with it. In fact, we have had more pleasant business dealings with Link-Belt than any other Company, and we have been interested in the purchase of seven machines from Link-Belt.

It is pretty hard for us to say enough for Link-Belt machines and the Link-Belt organization, as they have always been the same to us.

Yours very truly,
PETERSON & SIMMONS
By J. J. Peterson

LINK-BELT COMPANY
300 W. Pershing Road
CHICAGO

Offices and Distributors
in All Principal Cities

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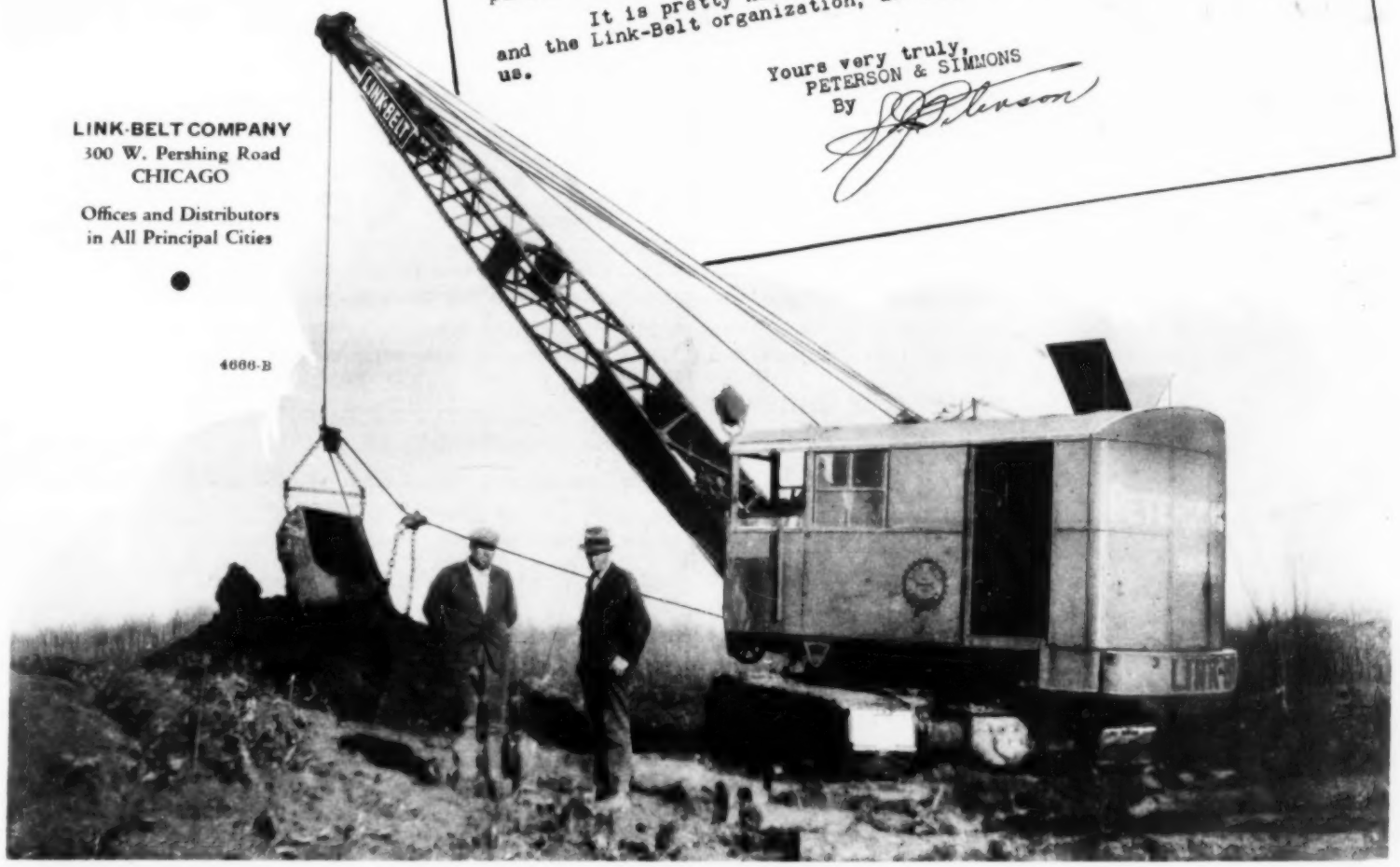
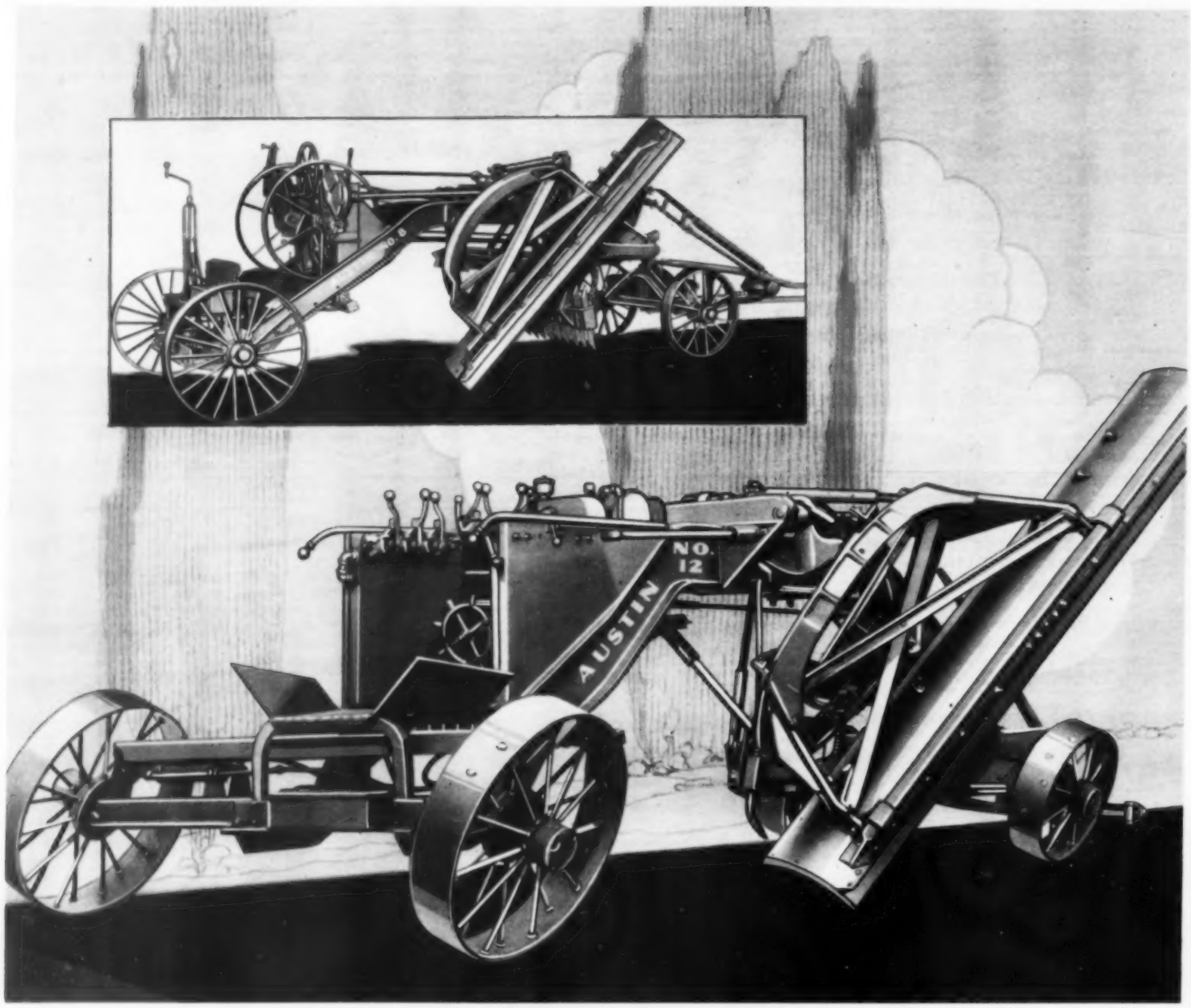




New Austin Blade Graders *. . . with* HYDRAULIC Controls

UNDER every operating condition, from the deepest cuts of new construction to the light, precise work of road maintenance, greater standards of performance are set by the new 1933 Austin Road Graders offering HYDRAULIC CONTROL as optional equipment.

Better work because of smooth, accurate blade and scarifier adjustment...faster work because of instant response to controls—combine to mean lower cost per job or more accomplished per dollar of appropriation.

The new Austin No. 12 and No. 10 Road Graders carry to a still higher point the standards of reserve strength, extra capacity and extreme flexibility so well proven in the Austin No. 101 which they succeed. The Austin No. 8, patterned closely after the No. 12, offers in an 8-foot blade grader, every feature of the larger machines except hydraulic control.

Complete information about these New Graders and other New 1933 Austin-Western Road Machinery is now ready. Write today!

The Austin-Western Road Machinery Co., Home office 400 North Michigan Avenue, Chicago, Illinois. Branches in principal cities.

103

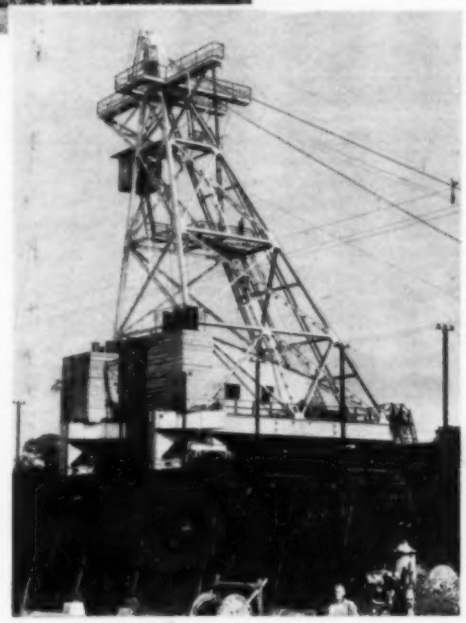
The Austin-Western ROAD MACHINERY CO.

ROAD ROLLERS, CRUSHING & SCREENING PLANTS, SCARIFIERS, SWEEPERS & SPRINKLERS, ROAD GRADERS, ELEVATING GRADERS, MOTOR GRADERS, PLOWS & SCRAPERS, BITUMINOUS DISTRIBUTORS, DRAGS, SHOVELS & CRANES, DUMP WAGONS, SNOW PLOWS.

Concreting costs cut

with G-E EQUIPMENT

General view of the G. E. equipped cableway at Madden Dam. This cableway was designed and furnished by the Lidgerwood Manufacturing Co., Elizabeth, N. J.



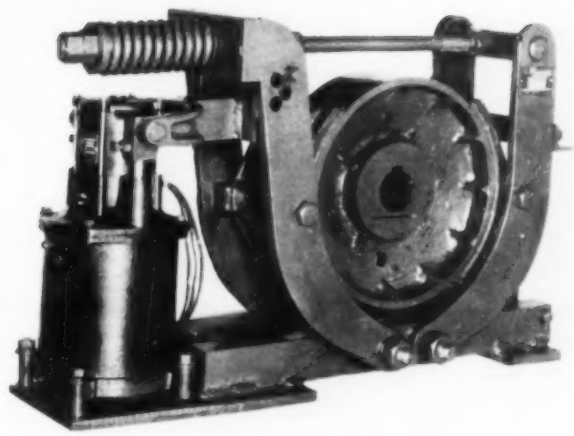
Close-up of the "head" or control tower, where G-E control centralizes every operation in the hands of a single operator

IN constructing the Madden Dam, a 1325-foot G-E motorized cableway is being used by the contractors, the W. E. Callahan Construction Company, to cut costs.

This G-E equipment gives to a single operator, stationed in the head tower, complete control of the operation of the cableway. From there, he can handle material over an area of about 15 acres. So well does the electric equipment function that the average length of a trip is only about three minutes—and more than 20 tons of concrete "ride" the bucket every trip!

The construction of Madden Dam further emphasizes the ability of General Electric to supply complete electric equipment . . . . . motors, controllers, power and control cable, transformers, etc. . . . . which meets exactly every construction need.

Why not call in a G-E engineer before starting the next big job? Just address the G-E Office nearest you; or, General Electric Company, Schenectady, N. Y.



Because of the inertia of the movable towers at Madden Dam, G-E Thrustor-operated brakes were selected for the travel motors. These brakes, by providing smooth, gradually applied retarding torque, assure the maximum degree of safety, and reduce maintenance

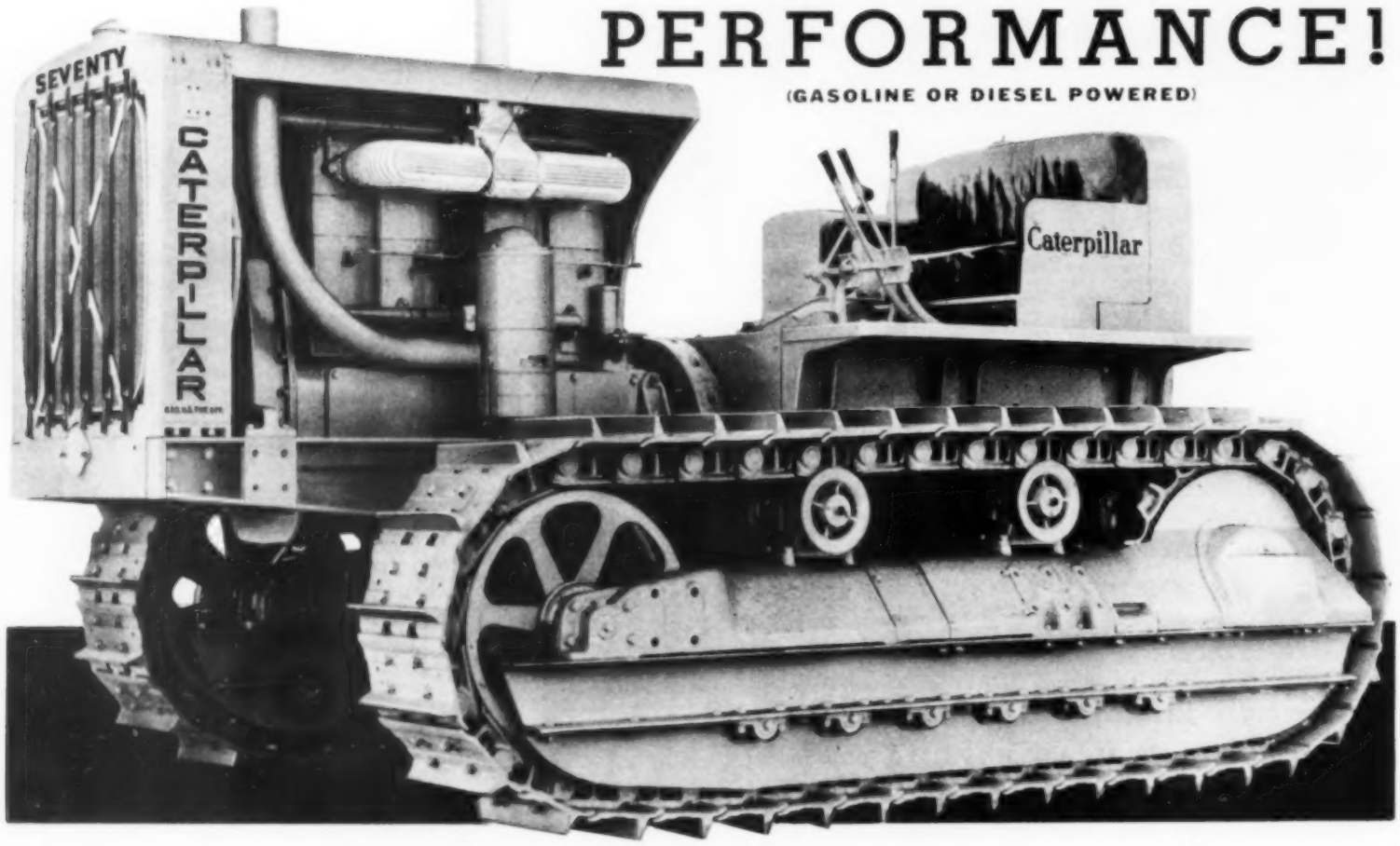
200-687

GENERAL ELECTRIC

BASE YOUR COSTS ON THE NEW "CATERPILLAR" SEVENTY

PERFORMANCE!

(GASOLINE OR DIESEL POWERED)



15 tons of shrewdly-proportioned weight — 15 tons of "Caterpillar" quality and stamina! . . . Ample weight to balance the tremendous traction of broad tracks that grip mightily with 24½ square feet of ground contact! . . . A rugged engine (gasoline or Diesel) that develops 76 maximum horsepower at the drawbar — power to balance generous weight and positive traction! . . . Power delivered through an 8-speed transmission (6 forward and 2 reverse)—a transmission of advanced and exclusive "Caterpillar" design, that responds in every speed to a single gear-shift lever! A flexibility to handle every load, job and condition at the speed which assures utmost efficiency of fuel and time . . . A chassis of super-strength — that features an arc-welded track roller frame and a yoke-type front idler mounting of distinctive "Caterpillar" design . . . Visibility that gives the "Caterpillar" Seventy's driver a clear view ahead, behind and to either side . . . Dust-protection and lubricant-retention developed to a degree never before achieved in a big tractor!

The "Caterpillar" Seventy Tractors present an array of new and thoroughly proved performance features to put the results of the heavy-duty power user on a new basis—to declare more emphatically than ever "Caterpillar" leadership and the proverbial "Caterpillar" slogan: better, quicker, cheaper!

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about the giant new Seventys and all other "Caterpillar" products from your "Caterpillar" dealer — he's in step with 1933!

CATERPILLAR
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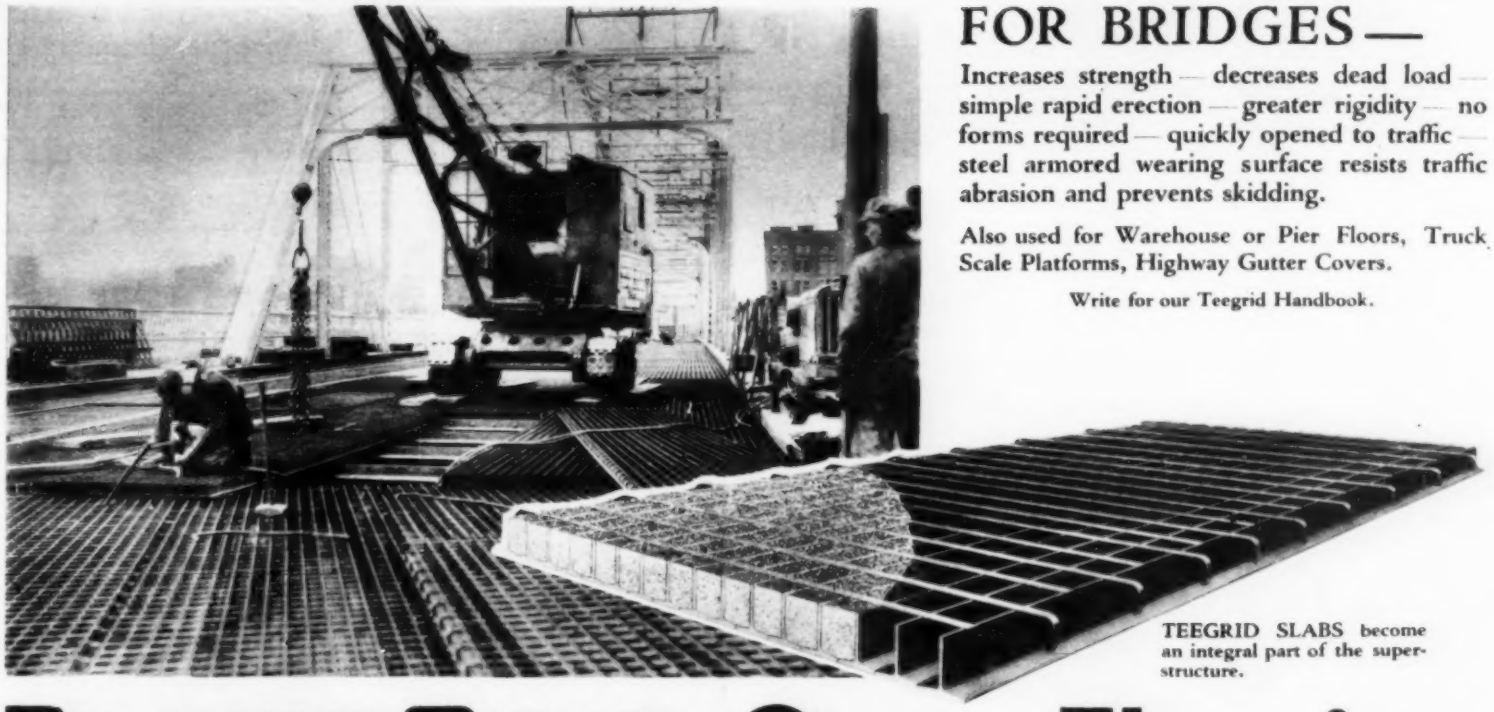
TRACTOR

TEEGRID Floor System

PATENT APPLIED FOR



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Increases strength — decreases dead load — simple rapid erection — greater rigidity — no forms required — quickly opened to traffic — steel armored wearing surface resists traffic abrasion and prevents skidding.

Also used for Warehouse or Pier Floors, Truck Scale Platforms, Highway Gutter Covers.

Write for our Teegrid Handbook.

TEEGRID SLABS become an integral part of the superstructure.

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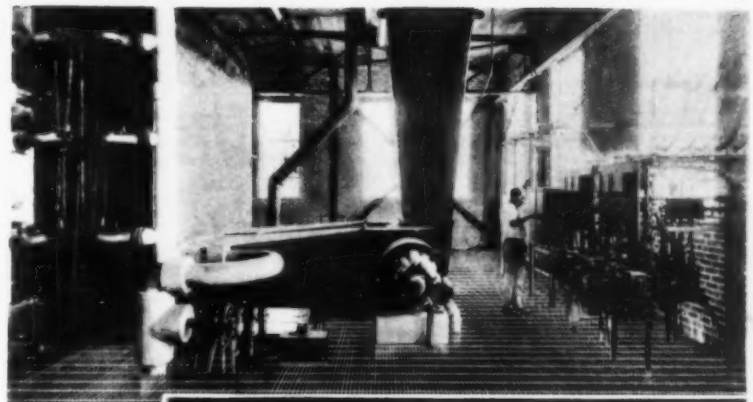
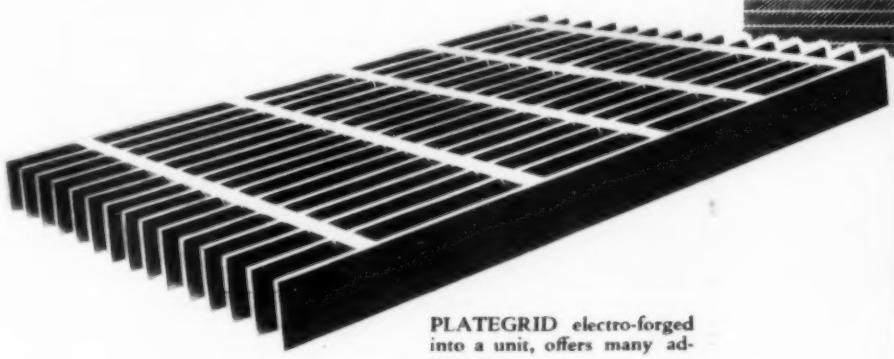
PATENT APPLIED FOR

Furnished in various types, sizes and finishes to meet exact requirements for an all-steel grating as an efficient open type flooring. A one-piece construction permitting maximum passage of light and a minimum resistance to the flow of air; free from cuts, rivets or mechanical joints — no sheared edges or holes. The uniform openings make it impossible for debris, dirt, snow or ice to collect.

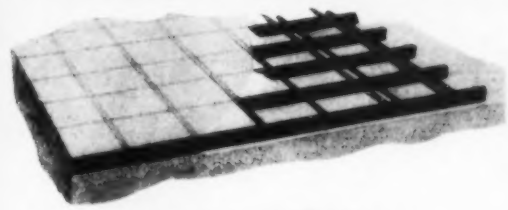
Plategrid Open Flooring is successfully and economically used in power houses, pumping stations, water works, refineries, gas plants, sewer disposal plants, foundries and industrial plants, for floors, walkways, platforms, sidewalks and stair treads.

Catalog on request.





PLATEGRID electro-forged into a unit, offers many advantages.



FLOORGRID

PATENT APPLIED FOR

An excellent wearing surface for heavy duty floors. The unit is embedded in concrete or a mastic fill and gives maximum protection.

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The Blaw-Knox (Ateco) *Hydraulic* BULLDOZER

—moves more dirt at less cost « «

The rigid box type of construction conserves tractor power by an amazing reduction in Bulldozer weight without sacrifice of strength.

Two way control—positive downward pressure on the curved digging bowl *digs in* and speeds up the bulldozing operations.

The Hydraulic power which lifts and applies downward pressure to the bowl is concealed in the sidearm—away from dust and dirt.

Easy and quick to put on.

If you want to know more about the Blaw-Knox (Ateco) Hydraulic BULLDOZER—send for Bulletin No. 1394.

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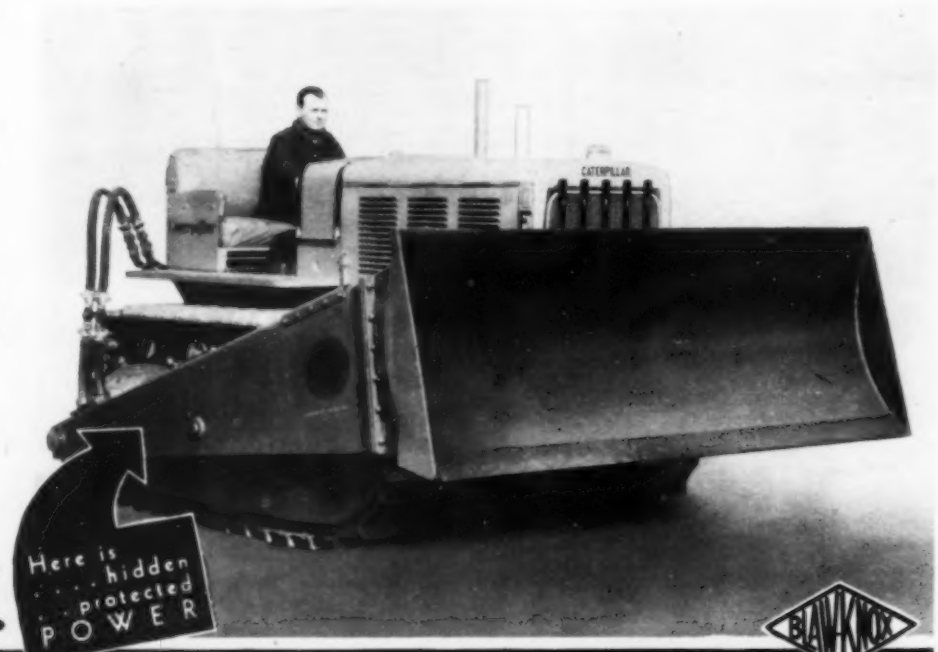

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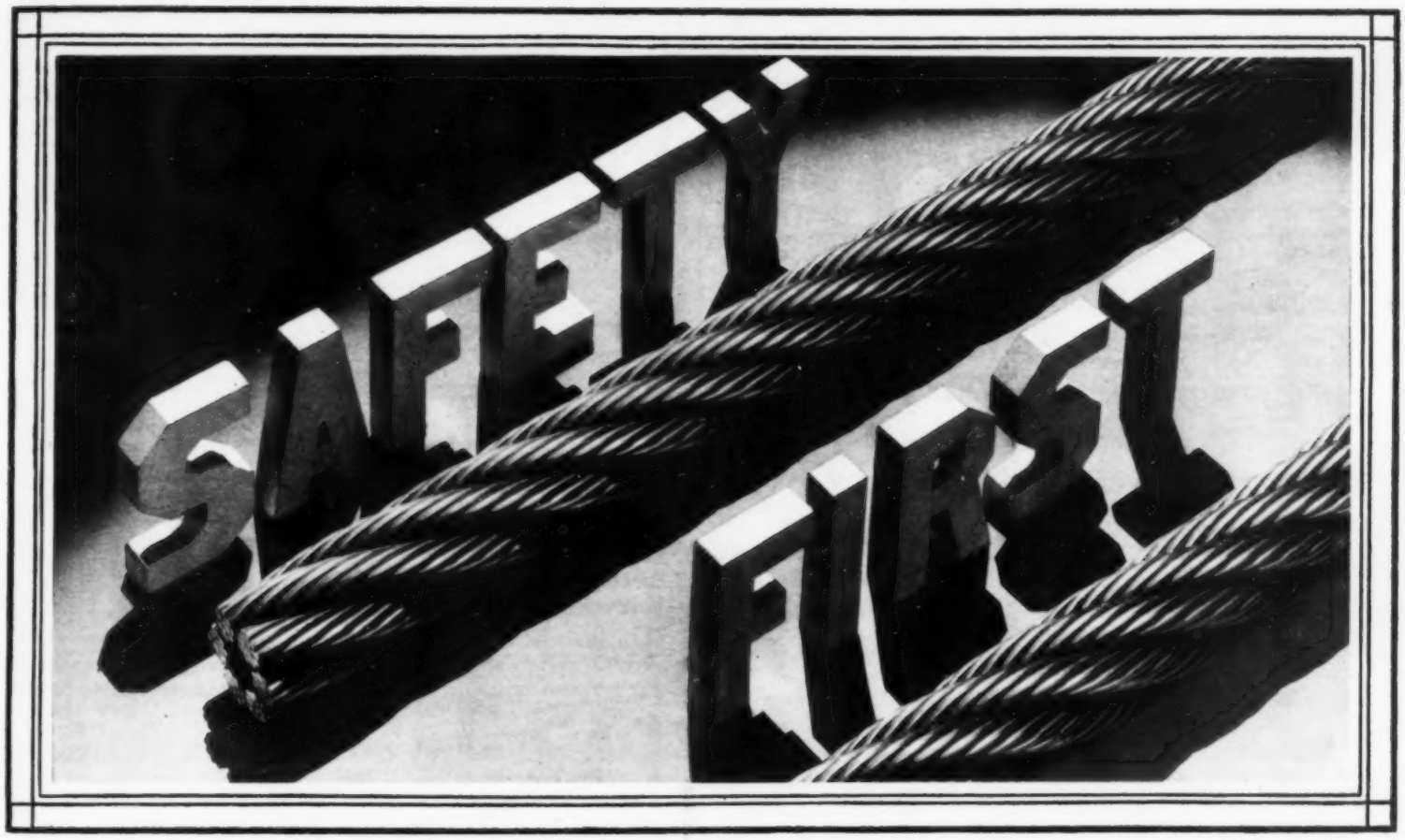

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To insure Roebling Rope of unsurpassed dependability:—

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IF A common grade shovel retails for **$1.25** and the Red Edge for **$2.00** and the Red Edge lasts only twice as long as the cheaper shovel then the buyer saves **50c**. By investing **75c** he prevents later spending **$1.25**. Thus **75c** makes a clear profit of **50c** or pays a dividend of **66⅔%** on the investment. The shrewd purchaser saves a minimum of **$6.00** a dozen by purchasing the best. Why shouldn't the Red Edge outwear the common shovel two to three times?

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RED EDGE KNOWN THE WORLD OVER

In the new Red Edge Solid Shank, equipped with the A. B. W. Shock Band the handle strength is increased 21%. Ask your Jobber to show you the latest Red Edge Line.

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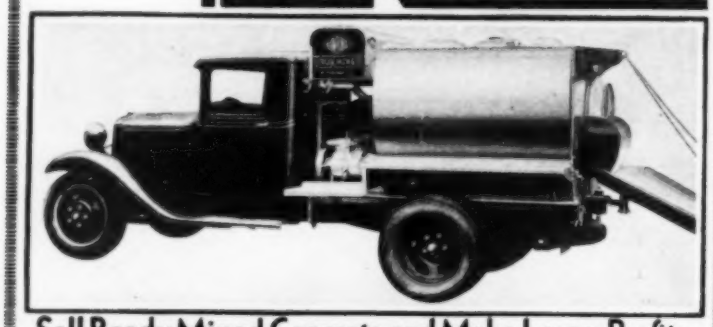
the Blaw-Knox TRUKMIXER



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Make more profit on the sale of aggregates and cement by selling them in the form of ready mixed concrete. Contractors agree that they can buy ready mixed concrete to better advantage than it can be mixed on the job.

The Blaw-Knox TRUKMIXER is made to give you good profits with minimum use. It is strong, sturdy, engineered to the last notch, low in first cost and extremely low in maintenance costs.

Put it up to Blaw-Knox to show you facts and figures proving that you can profit through the use of a TRUKMIXER in your locality.

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For Better Fragmentation

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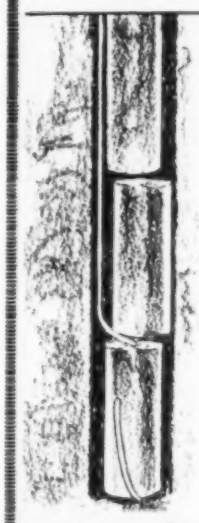

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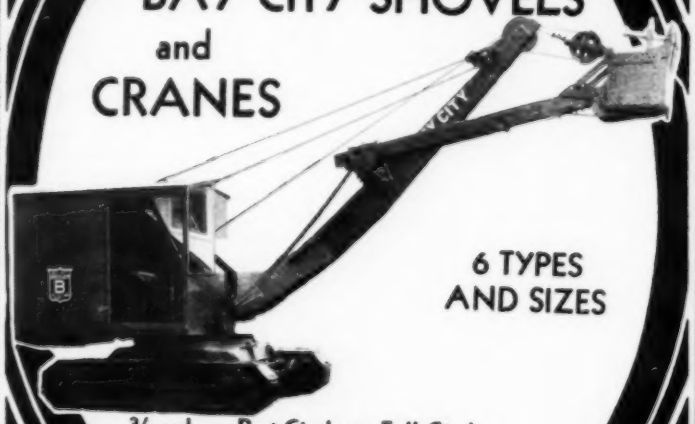

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1/2-yd. — Standard or Heavy Full Circle
3/4-yd. — Heavy Duty
1-yd. — Heavy Duty
3- to 18-Ton Cranes

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Builders of Dependable Shovels — Cranes — Dredges

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BAY CITY, MICH.

Light Your Night Jobs with DIETZ "Economy" Floodlights

WORKERS save time and accomplish more when good lighting is provided on night emergency jobs.

At small expense Dietz Economy Floodlights solve this problem. They also provide needed light for material yards, loading platforms and numerous other locations.

With Economy Floodlights you get powerful, wide angle illumination. They are waterproof and weatherproof. The hyperbolic reflector is chromium plated. Bulb is 100-watt, 115-volts (user can substitute a 32-volt or 220-volt bulb if desired). Body of lamp is made of steel, black enameled, with cadmium plated door rim and base.

List Price $8.50 Each

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REDUCES DIRT HAULING COSTS
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THE KOEHRING WHEEL DUMPTOR

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Ample capacity — equal speeds, forward or reverse — front dump — constant mesh transmission — instantaneous gravity dump — short wheel base!

These are only a few features to insure easy operation — flexibility of movement — minimum of turns — fast loading of the Koehring Wheel Dumptor.

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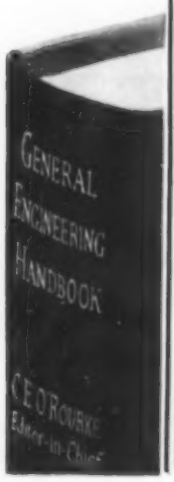

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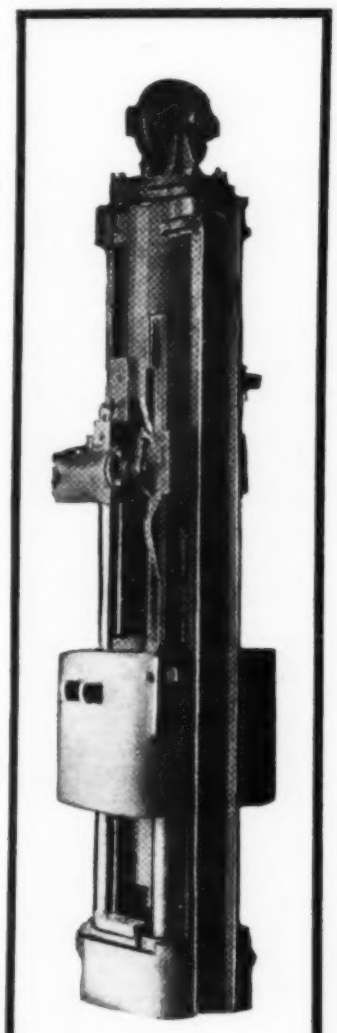

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